

NEW HYSTRICHOPSYLLID SIPHONAPTERA

By F. G. A. M. SMIT

THE new fleas dealt with in this publication all belong to the family Hystrichopsyllidae. A new subfamily with a new genus and a new species is erected; seven new species and one new subspecies of *Rhadinopsylla*, subgenus *Actenophthalmus*, are described, one species of the same subgenus is redescribed and another is recalled from synonymy and attention is drawn to the taxonomic value of the structure of the metathorax in *Rhadinopsylla*.

Holotypes are in the British Museum (Natural History), unless stated otherwise.

Family *HYSTRICHOPSYLLIDAE*

ACEDESTIINAE subfam. nov.

Separable from any other Hystrichopsyllidae by the oblique genal ctenidium consisting of four pointed spines, and from all except certain genera of Anomiopsyllinae (*Anomiopsyllus*, *Stenistomera*, *Eopsylla*, *Callistopsyllus* and *Megarthroglossus*) by having only one row of setae on the thoracic and abdominal terga (with the partial exception of tergum I in one of the two known representatives).

Club of antenna composed of eight or nine segments. Antennal fossa closed. Eye much reduced or vestigial. Labial palp short, consisting of four or five segments. Central tuber absent. Genal ctenidium oblique. Pronotal ctenidium present. Prosternosome without a sinus for the reception of the first link-plate. One dorsal and one subventral pseudoseta each side under the collar of mesonotum. Inner internal rod of mid and hind coxae short. Inner and outer surfaces of femora without lateral setae. The three nota and terga I (or II) to VII with only one row of setae; anterior terga each with an inconspicuous subdorsal spinelet each side. Sternum VIII of female with an acute ventro-posterior angle and without setae.

The two included genera are both monotypical and only known from the female sex; they occur in Australia where they are the only representatives of the family Hystrichopsyllidae. The simplified structure of these fleas indicates that they are true nest-fleas, as would be suspected from their apparent rarity.

Genus *ACEDESTIA* Jordan, 1937

Acedestia. Jordan, 1937, *Novit. zool.* 40: 312. Type species: *A. chera* Jordan.

Head integricipit, shorter than high. Frontal tubercle small, contained in a pit. No arch of tentorium visible in front of the eye. Maxillary and labial palps short,

the latter five-segmented. Eye reduced. Preantennal and postantennal regions of head each with one row of setae. Antennal club consisting of nine segments. Genal ctenidium composed of four sharply pointed spines. Pronotum short; pronotal ctenidium consisting of sharply pointed spines, the more dorsal of which are far longer than the pronotum. All nota and terga II-VII each with only one row of normal setae, tergum I with an incomplete additional row (as in Pulicidae). Metepimeron extending far dorsad of its spiracular fossa; metasternum with a squamulum. A subapical patch of small spiniform setae on inner side of hind coxa. Segment V of all tarsi with four lateral pairs of setae, fore and mid tarsi also with a pair on the planta between the members of the first lateral pair. Spiracles of metepimeron and terga II-VII ovate, subacuminate posteriorly. Female with two antesensilial setae; sensilium extremely slightly convex dorsally, with about 14 trichobothria each side; anal stylet long and slender, with a long apical seta and two minute subapical ones.

The only known species, *A. chera* Jordan, occurs in West Australia (Mahogany Creek, Perth) and South Australia (Yorke Peninsula),¹ and only two females of it have been obtained. Both were collected from members of the marsupial family Peramelidae (bandicoots).

IDILLA gen. nov.

The following generic description is based on the female sex only. Head markedly fracticipit, longer than high. Frontal tubercle absent. No arch of tentorium in front of the eye, but the basal portion of the tentorial rod present. Maxillary and labial palps short, the latter four-segmented. Eye vestigial. Preantennal region of head with one row of setae and a large additional seta some distance above the eye. Antennal club consisting of eight segments. Postantennal region with one seta obliquely above the antennal scape, the posterior row represented by only one fairly large ventro-marginal seta. Genal ctenidium consisting of four pointed spines. Pronotum very short; pronotal ctenidium present, its spines much longer than the pronotum. All nota and terga I-VII each with only one row of strongly reduced setae. Metepimeron not extending far dorsad of its spiracular fossa; metasternum without a squamulum; no subapical setae on inner side of hind coxa; segment V of all tarsi with three lateral pairs of plantar setae and one pair on the planta between the members of the first (basal) pair. Spiracles of metepimeron and terga II-VII circular. Two antesensilial setae. Sensilium distinctly convex dorsally. Anal stylet fairly long, with a short apical seta and two minute subapical ones.

Type species: *I. caelebs* sp. n.

¹ Jordan (1937, *Novit. zool.* 40: 315) gives the data of the paratype as "Queensland: Yorke Pen., off *Perameles gunnei*."—Yorke Peninsula (not Cape York Peninsula, which is in Queensland) is in South Australia, and the host was presumably misdetermined, since *Perameles gunni* is known only from eastern Victoria and Tasmania. Dr. G. M. Dunnet, of Canberra, very kindly informed me (a) that, as far as is known, the collector of the paratype (Professor Wood Jones) never collected on the Cape York Peninsula, and (b) that the host will very likely have been *Perameles myosura*, which is the form of *Perameles* occurring in South Australia and west to Western Australia.

Idilla caelebs sp. n.

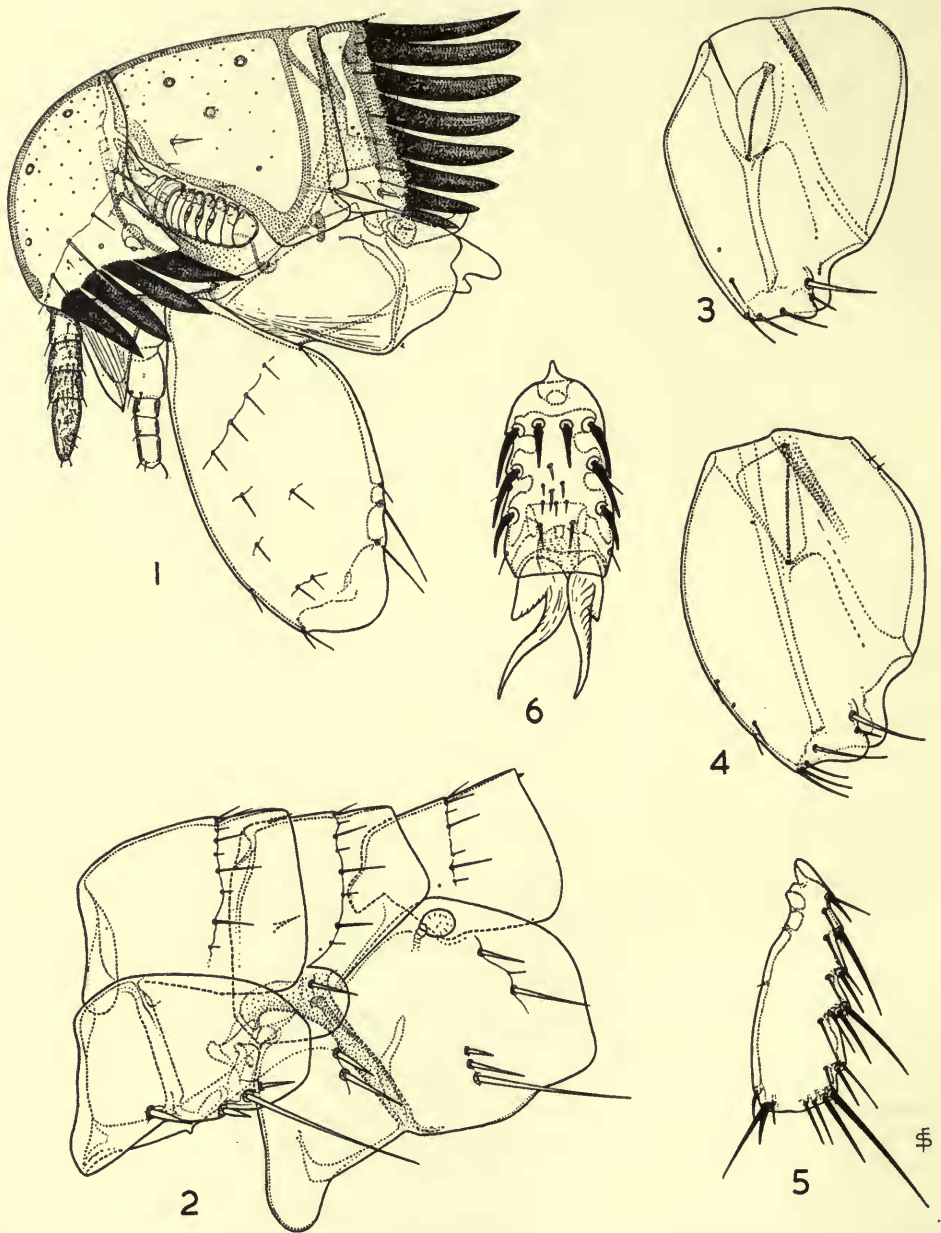
(Text-figs. 1-8)

TYPE MATERIAL. Female holotype collected at Colo Vale, near Mittagong, New South Wales, Australia, from *Antechinus flavipes*, on 2.vi.1954, by A. L. Dyce.

DIAGNOSIS. This new species is easily recognizable by the shape of the genal and pronotal ctenidia, the fracticipit head, the absence of a pleural arch of the metathorax, the three lateral pairs and one basal plantar pair of setae on all last tarsal segments and the exceptionally strongly reduced chaetotaxy.

DESCRIPTION. HEAD (Text-fig. 1). Markedly fracticipit. Frontoclypeal margin smoothly and fairly strongly rounded, without an angle or a frontal tubercle. Oral margin very short. Preoral tuber hardly differentiated from the rest of the frontal incassation, which is fairly thick and even throughout. Preantennal part of head with one row of four setae, two of which are of moderate length, the other two short and thin; an additional fairly large seta between the uppermost seta of the row and the vestigial eye. Genal ctenidium oblique, consisting of four sharply pointed spines of which the third is very slightly spatulate. Genal process short, its tip visible below the fourth genal spine. Eye vestigial. Maxillary palp even a little shorter than the labial palp; the latter consists of only four segments and reaches to about two-fifths the length of the fore coxa. Stipes, laciniae and epipharynx also very short. Antennal club consisting of eight segments, the first two segments apparently being amalgamated; scape and pedicel each with only one small posterior seta. The tentorial rod is short, only its basal portion being retained, and it does not reach the preantennal part of the head. Interantennal suture and ridge very well developed. Postantennal region of head with only one strongly shortened (hence spiniform in appearance) seta above the antennal pedicel and two minute setae bordering the antennal fossa; of the usual posterior row of setae only a minute dorsal seta and a normal-sized ventral seta are retained, but the latter seta is most unusually placed, namely marginal and in a small sinus. The true occiput is teat-shaped and extends to the posterior margin of the pronotum.

THORAX (Text-figs. 1, 2). Pronotum very short, with one row of six strongly reduced setae on each side. Pronotal ctenidium consisting of 16 spines which are distinctly curved; the dorsal spines are more than thrice as long as the pronotum anterior to these spines. Mesonotum with one row of four very small setae each side; with a dorsal and a subventral short pseudoseta under its collar. Mesepisternum with only one subspiniform ventral seta, mesepimeron with three ventral setae, the first of which is marginal and spiniform, the second very long and the third short. Metanotum also with one row of four strongly reduced setae each side, metepisternum with one short seta, its semicircular posterior margin not connecting up dorsally with the lower end of the ventral margin of the metanotum. Metasternum with two fairly stout and short setae and without a squamulum, metepimeron with two setae obliquely below the rounded spiracular fossa and a vertical subventral row of three setae, the lowest of which is the longest. Pleural arch of metathorax absent; the furca long and narrow and bent backwards.



FIGS. 1-6. *Idilla caelebs* gen. n., sp. n. (holotype). 1. Head, prothorax and fore coxa. 2. Mesothorax, metathorax and tergum I. 3. Mid coxa. 4. Hind coxa. 5. Hind tibia. 6. Fifth hind tarsal segment.

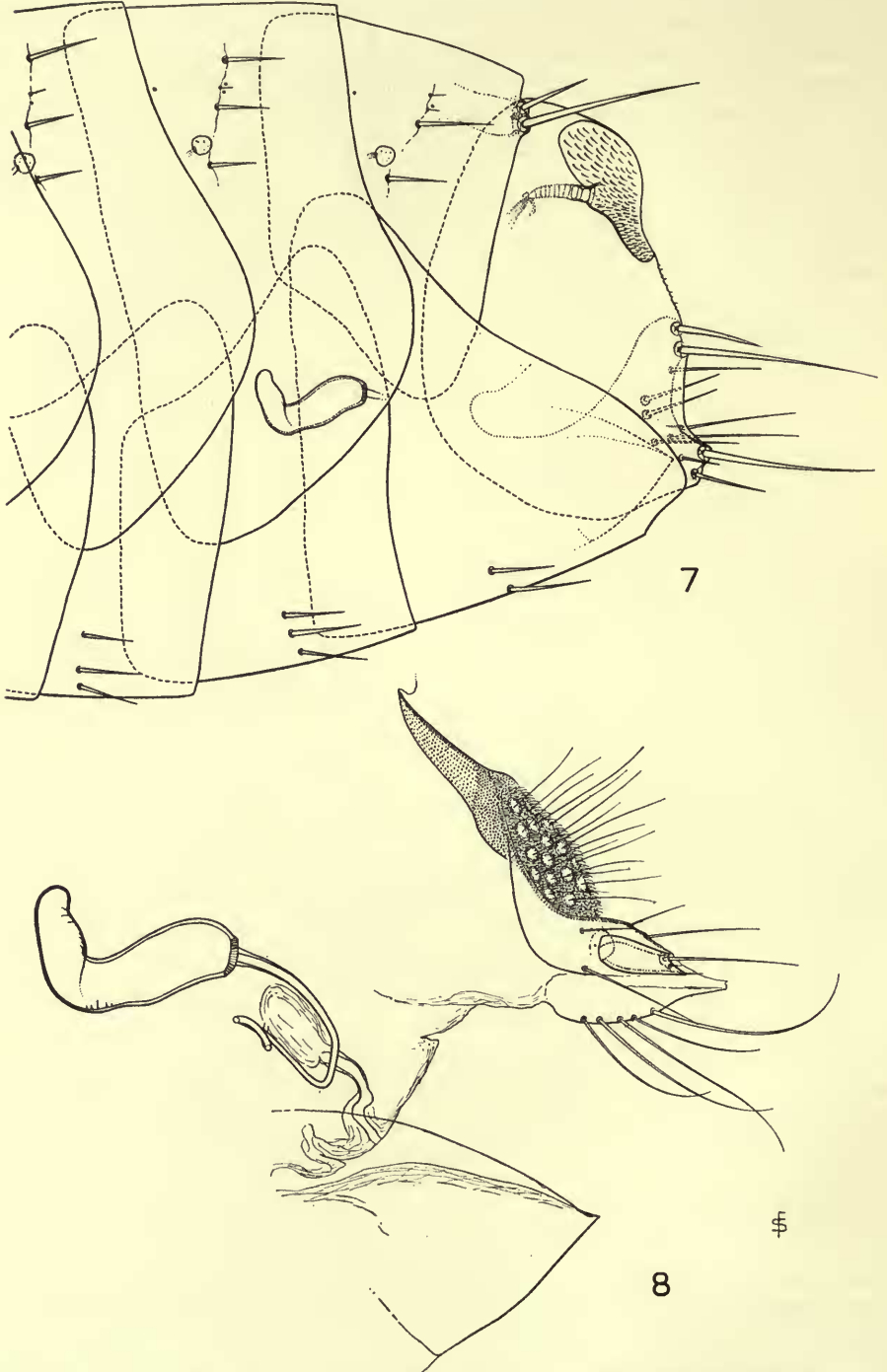
LEGS. Outer surface of the broad fore coxa (Text-fig. 1) with about a dozen very small lateral setae; mid and hind coxae (Text-figs. 3, 4) without lateral setae on either inner or outer side, but with a few short preapical and apical setae. Outer internal ridge of mid and hind coxae somewhat shorter than the inner internal rod. All femora without lateral setae and the outer of the two dorso-apical setae very short, especially on the fore femur. Tibiae without lateral setae on the anterior longitudinal half (Text-fig. 5); fore tibia with five groups of dorso-marginal setae, consisting of 2, 3, 3, 2 and 4 setae respectively, mid tibia with six groups of 2, 2, 2, 3, 2 and 4 setae, and hind tibia (Text-fig. 5) also with six groups, consisting of 2, 2, 2, 4, 2 and 4 setae respectively. Ratio of lengths of tibiae and tarsal segments (petiolate bases omitted):

Leg	Tibia	Tarsal segments					V
		I	II	III	IV		
Fore	41	12	13	12	12	28	
Mid	57	17	17	15	12	29	
Hind	62	34	25	18	14	30	

All tarsal setae are rather short and none of the apical setae of the second hind tarsal segment reaches beyond the apex of the third segment. Fifth segment of all tarsi with only three pairs of lateral plantar setae but with a basal plantar pair between the members of the first lateral pair; the two preapical lateral setae very short and on the distal two-thirds of the planta only a few minute setae (Text-fig. 6).

UNMODIFIED ABDOMINAL SEGMENTS (Text-fig. 7, part). Terga I-VII each with only one row of extremely short setae; the rows of the two sides of each tergum do not reach the dorsal margin; on each side of terga I-VI these rows consist of three setae (excluding intercalary setae); tergum VII with only two setae each side. Terga I-III each with one subdorsal small marginal spinelet per side. Female with two antesensilial setae on a very short pedestal, the upper seta two-fifths the length of the lower. Spiracular fossa of terga II-VII rounded and situated a little above the lowest seta of the row. Basal sternum without lateral setae and with only one ventral seta each side; sterna III-VI each with a very short subventral row of three smallish setae per side.

MODIFIED ABDOMINAL SEGMENTS AND GENITALIA OF FEMALE (Text-figs. 7, 8). Posterior margin of sternum VII forming a subventral lobe with a convex upper and a short and slightly concave lower margin; with only two setae, one near and one at the ventral margin. Spiracular fossa of tergum VIII large, its dorsal half much wider than the ventral half; posterior margin of tergum VIII with two groups of two setae each; six slender genital setae on the inner side of the apical portion of tergum VIII. Sternum VIII rather high, with an acute ventro-posterior angle and without setae. Sensillum dorsally distinctly convex. Anal stylet nearly thrice as long as its maximum width, with a strongly oblique apex and one fairly long and two minute apical setae. Anal segment pyriform, as in Text-fig. 8, with relatively few but long and slender setae. Spermatheca with a narrow bulga and a shorter and narrower hilla; there are only a few indications of some ventral internal striae



FIGS. 7, 8. *Idilla caelebs* gen. n., sp. n. (holotype). 7. Abdominal segments V-VIII and spermatheca. 8. Sensillum, anal segment, sternum VIII and genitalia.

at the place where the bulga merges into the hilla. Ductus spermathecae and ductus bursae rather short; the bursa copulatrix is poorly preserved and the junction of the ductus spermathecae with the bursa is invisible; there is no trace of a ductus obturatus.

LENGTH. ♀ $1\frac{1}{4}$ mm.

REMARK. After the figures had been drawn the specimen was remounted in order to make certain details more clearly visible. As a result the position of certain structures, e.g. the mouthparts, prosternosome and fore coxa are now slightly different from those shown in the figures.

Subfamily RHADINOPSYLLINAE

Rhadinopsylla (Actenophthalmus) mesoides sp. n.

(Text-figs. 9, 11, 13)

Rhadinopsylla "mesa Jord." Jordan, 1938, *Novit. zool.* 41: 110.

TYPE MATERIAL. Male holotype from near the Gave [= mountain stream] d'Ossone, above Gavarnie, Hautes-Pyrénées, France, 1460 m., *Talpa europaea* [accidentally; true host *Pitymys savii pyrenaicus*], 13.vii.1936, K. Jordan.¹

DIAGNOSIS. The new species is related to *Rhadinopsylla (Actenophthalmus) mesa* Jordan & Rothschild, but readily distinguishable from the latter by having five narrow genal spines instead of six broader ones. The movable process of the clasper is also much narrower in the new species.

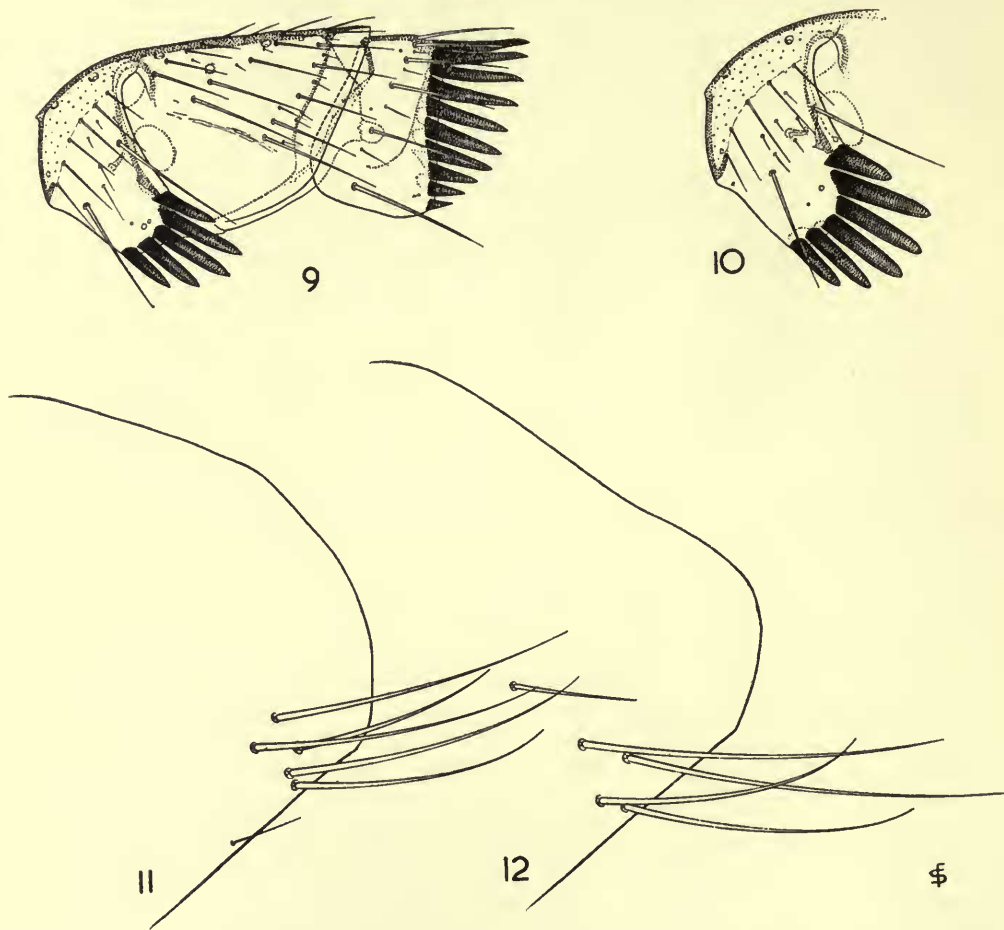
DESCRIPTION. HEAD (Text-fig. 9). Frontal tubercle well developed. Submarginal frontal row with six setae; in *R. mesa* (Text-fig. 10) this number varies from five to six. Between this row and the genal ctenidium two long setae and several scattered minute setae. Genal ctenidium of five narrow sharply-pointed spines, the uppermost of which reaches to about three-fifths the dorsal length of its neighbour. In *R. mesa* this ctenidium consists of six (in two of the 11 specimens examined there are five spines on one side of the head) much broader and blunter spines, and the uppermost is basally distinctly broader than its neighbour. The five-segmented labial palp does not quite reach the apex of the fore coxa.

THORAX. Pronotum ventrally nearly twice as long as dorsally, with a main row of five setae per side, the lower of which being situated anterior to the midline of the notum (Text-fig. 9); in *R. mesa* the pronotum is ventrally less long. Pronotal ctenidium with 21 spines, the more ventral of which decrease progressively and considerably in size; in *R. mesa* the number of pronotal spines, which are blunter, varies from 21-22, only in one male the number is 20. Mesonotum with a main row of five setae each side, mesosternosome with four setae; metanotum with a main row of five setae per side, metepisternum with three setae, metasternum with one and metepimeron with five setae. Metathorax as in *R. mesa* (Text-fig. 66), with

¹ The specimen was obtained on a mole, but this is almost certainly accidental. Jordan (1938: 108) records obtaining *Pitymys savii pyrenaicus* at the same place and altitude and notes that one of them was trapped in a mole-run. There can be but little doubt that the *Pitymys* is the true host.

a long suture along the dorso-anterior margin of the metepimeron extending downwards to about the middle of the metepisternum.

LEGS. Hind tibia without setae on the inner side. Longest apical seta of the second hind tarsal segment not quite reaching to the apex of the third segment (in



FIGS. 9, 11. *Rhadinopsylla (Actenophthalmus) mesoides* sp. n. (holotype). 9. Head and prothorax. 11. Sternum VIII. FIGS. 10, 12. *Rhadinopsylla (Actenophthalmus) mesa* J. & R. (Steingletscher, B.O., Switzerland). 10. Preantennal part of head, ♂. 12. Sternum VIII, ♂.

R. mesa well beyond this apex). Fifth segment of all tarsi with four pairs of lateral plantar setae.

UNMODIFIED ABDOMINAL SEGMENTS. Numbers of setae per side in the main row of terga I-VII: 4, 6, 6, 6, 6, 6, 5; only one seta below the spiracle on terga III-VI. Numbers of spinelets at each side of the posterior margin of terga I-VI: 2, 3, 3, 2

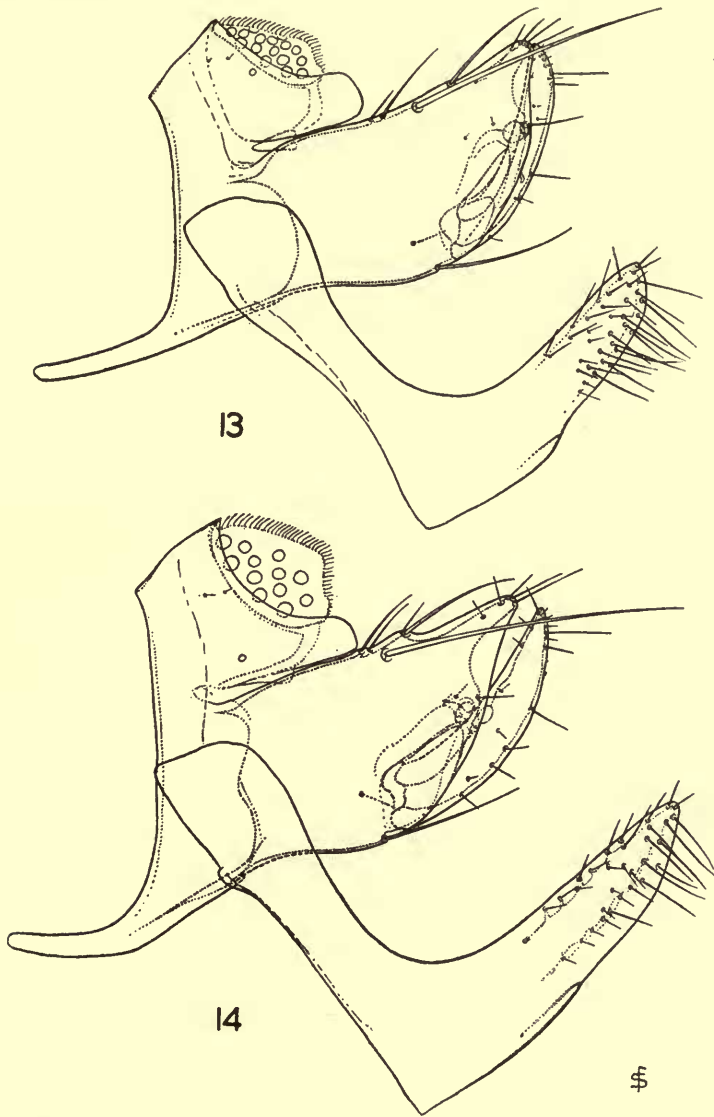


FIG. 13. *Rhadinopsylla (Actenophthalmus) mesoides* sp. n. (holotype). Clasper and sternum IX. Fig. 14. *Rhadinopsylla (Actenophthalmus) mesa* J. & R. (Steingletscher, B.O., Switzerland). Clasper and sternum IX.

or 3, 1 or 2, 1. Numbers of setae per side on sterna II-VII: 0, 3 or 4, 3, 3, 3, 2 or 3.

MODIFIED ABDOMINAL SEGMENTS AND GENITALIA OF MALE (Text-figs. 11, 13). Tergum VIII without setae. Posterior margin of sternum VIII broadly but not very strongly rounded (Text-fig. 11); in *R. mesa* (Text-fig. 12) this margin forms a more distinct bulge and in the latter species the setae are placed farther away from the posterior margin. Clasper (Text-fig. 13), measured from tip of manubrium to apex of fixed process, about two and a half times as long as the movable process; fixed process of clasper with a less acute dorso-posterior angle than in *R. mesa* (Text-fig. 13, cf. Text-fig. 14), and the manubrium is markedly longer than in the latter species; the acetabular seta is placed below the lower end of the movable process. Movable process narrow, of equal width from base to near apex, only slightly curved; the fovea is situated a little above the middle of the anterior margin, in *R. mesa* a little below the middle. Distal arm of sternum IX (Text-fig. 13) more or less as that of *R. mesa* (Text-fig. 14), but relatively shorter and more setose. Sensillum with 12 trichobothria each side; this is also the usual number in *R. mesa*. The phallosome, which is so inconveniently uniform in the genus, does not differ much from that of *R. mesa*; only its overall length is less than that of *R. mesa* and the dorsal wall of the aedeagal inner tube is thinner.

LENGTH. ♂ nearly $2\frac{1}{2}$ mm. (*R. mesa* ♂ $2-2\frac{3}{4}$ mm.).

***Rhadinopsylla (Actenophthalmus) isacantha continentalis* subsp. n.**

(Text-figs. 15, 68)

Rectofrontia isacanthus Roths. Smit, 1950, *Ent. Ber.* 13 : 63, fig. 1.

Rhadinopsylla (Actenophthalmus) isacanthus (Rothschild) (part). Smit, 1954, *Danm. Fauna*, 60 : 50, figs. 46, 53, 54; Smit, 1957, *Handb. Ident. Brit. Ins.* 1 (16) : 34, 35, figs. 55, 62, 63.

The figure of the clasper in these two publications were made from a specimen from Buré d'Orval, France (now a paratype of *R. (A.) i. continentalis*) and those of the head and segment VII of the female from a specimen from Wageningen, Netherlands, since until a recent donation by Mr. R. B. Freeman there were only a few specimens from England in the Tring collection and these were not well mounted and not ideal for drawing purposes.

Rhadinopsylla (Actenophthalmus) isacantha (Rothschild). Smit, 1957, *Ann. Mag. nat. Hist.* (12) 10 : fig. 11.

TYPE MATERIAL. Male holotype, female allotype and 4 ♂, 8 ♀ paratypes from Buré d'Orval, Meurthe-et-Moselle, France, from nests of *Clethrionomys glareolus* (except for 1 ♀ collected off a specimen of *C. glareolus*, and 3 ♀ from "nest of mice"), holotype and allotype collected on 3.i.1934, paratypes: 1 ♂, 1 ♀, 2.i.1934; 1 ♂, 2 ♀, 3.i.1934; 1 ♀, 6.i.1934; 1 ♂, 1 ♀, 31.i.1934; 3 ♀, 29.iii.1934; 1 ♂ 14.iv.1934; all collected by H. Heim de Balzac.

DESCRIPTION. The new species only differs in the male from the nominate form, which is only known from England, by having a much shorter movable process of the clasper which consequently does not reach the apex of the fixed process, and by the distal arm of sternum IX being relatively slightly narrower (Text-fig. 15, cf. Text-fig. 16).

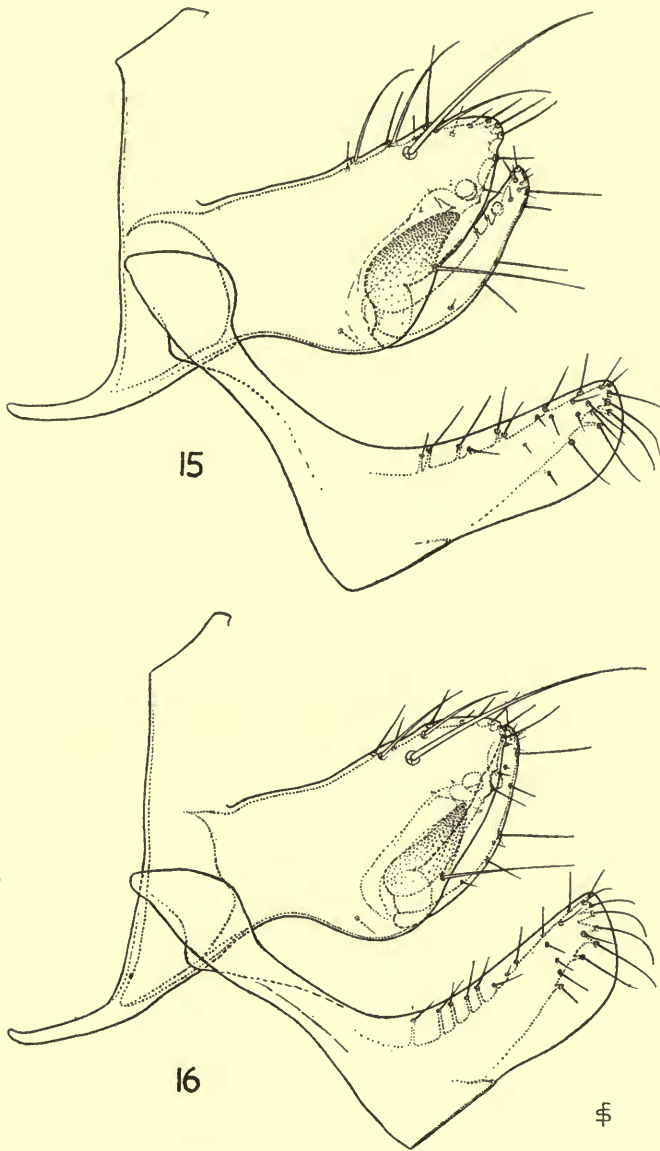


FIG. 15. *Rhadinopsylla (Actenophthalmus) isacantha continentalis* ssp. n. (holotype). Clasper and sternum IX. Fig. 16. *Rhadinopsylla (Actenophthalmus) isacantha isacantha* (Rothschild) (Compton, Berkshire, England). Clasper and sternum IX.

LENGTH. ♂ 2-2½ mm., ♀ 2¼-2¾ mm. (same as nominate subspecies).

REMARKS. Text-fig. 16 was drawn from a specimen which had hardly been cleared or flattened; Text-fig. 17 represents the clasper of the same specimen, but after treatment with caustic potash and consequent greater flattening—in this remounted specimen the movable process appears to be shorter than it was before, but this is only due to a slight moving downwards of the process; also the position of the acetabular portion of the movable process has changed in relation to the main part of the process. This illustrates clearly the desirability always to clear and mount fleas in a similar way, and when observing minor discrepancies between uncleared mounted and cleared mounted fleas of a certain form one should bear in mind that the differences may be more apparent than real.

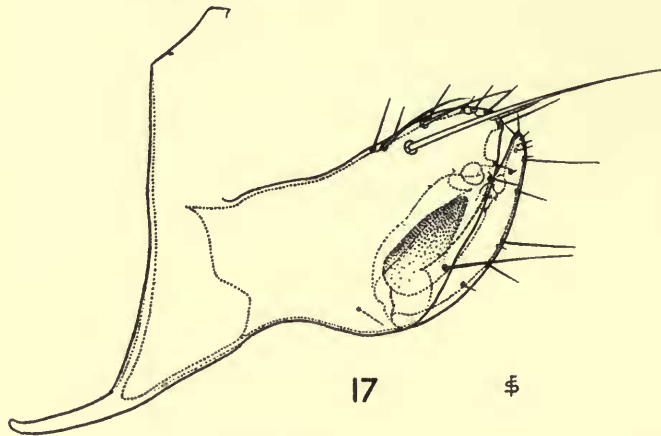


FIG. 17. *Rhadinopsylla (Actenophthalmus) isacantha isacantha* (Rothschild)
(Compton, Berkshire, England). Clasper.

The great rarity of this winter flea of voles is evident from the fact that the Tring collection contains only the type series of the new subspecies, and a sole female from The Netherlands, while Professor F. Peus informs me that he has not yet succeeded in collecting *R. isacantha* in Germany; of the nominate subspecies there are only 12 specimens in the Tring collection.

***Rhadinopsylla (Actenophthalmus) strouhali* sp. n.**

(Text-figs. 18, 20, 21)

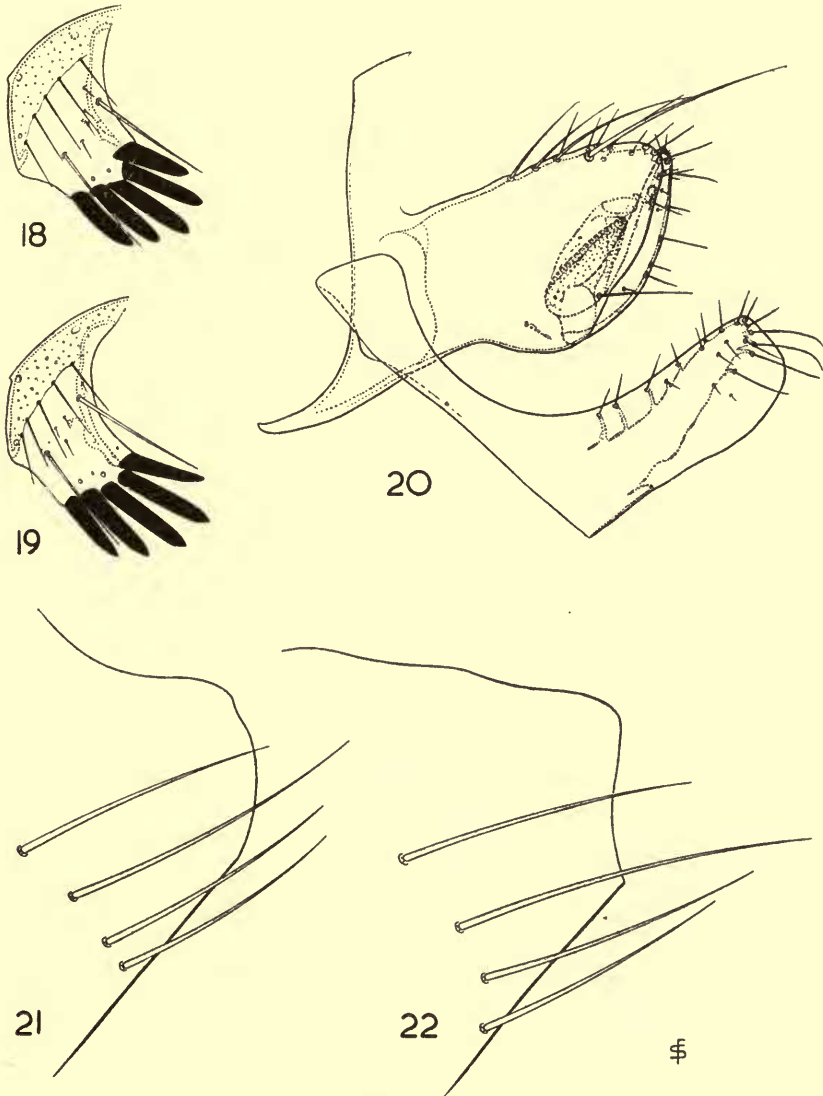
Rhadinopsylla (Rectofrontia) "isacanthus Roths." Wagner, 1936, *Konowia*, 15: 98, 101.

Rhadinopsylla (Actenophthalmus) "isacantha (Rothschild)". Smit, 1955, *Cat. Faun. Austr.* XIXz: 2.

TYPE MATERIAL. Male holotype from Moosbrunn, Lower Austria, from a nest of *Talpa europaea*, 1.iii.1927, M. Beier and H. Strouhal; in the Naturhistorisches Museum in Vienna.

DIAGNOSIS. The new species appears to be related to *R. isacantha* and differs from the latter by having a broader uppermost spine of the genal ctenidium, a shorter clasper and a truncate apex of the distal arm of sternum IX of the male. Female as yet unknown.

DESCRIPTION. The uppermost of the five genal spines is distinctly broader than its neighbour and its apex reaches to about two-thirds the length of the latter spine



FIGS. 18, 20, 21. *Rhadinopsylla (Actenophthalmus) strouhali* sp. n. (holotype). 18. Preantennal part of head. 20. Clasper and sternum IX. 21. Sternum VIII. Figs. 19, 22. *Rhadinopsylla (Actenophthalmus) isacantha isacantha* (Rothschild), ♂ (Compton, Berkshire, England). 19. Preantennal part of head. 22. Sternum VIII. ♀

(Text-fig. 18, cf. Text-fig. 19). The five-segmented labial palp is rather short and reaches to about two-thirds the length of the fore coxa. Pronotal ctenidium consisting of 23 spines. Metathorax virtually the same as that of *R. isacantha* (see Text-fig. 68). One seta on the inner side of the hind tibia. The longest apical spine of the second hind tarsal segment reaches to about the apex of the third segment. Last tarsal segment of all legs with four pairs of lateral plantar setae. Only one seta below the spiracle on terga III–VI. Number of marginal spinelets per side on terga I–VI, ♂ : 3 or 4, 3 or 4, 4, 3, 2 or 3, 1 or 3 respectively. Sensillum with 12 trichobothria each side.

Modified abdominal segments of male (Text-figs. 20, 21). Tergum VIII without setae. The row of four strong setae on sternum VIII (Text-fig. 21) is placed rather distantly from the convex posterior margin; in *R. isacantha* the posterior margin of sternum VIII below the angle is concave (Text-fig. 22). Clasper (Text-fig. 20, cf. Text-figs. 15, 16), measured from tip of manubrium to apex of fixed process, a little over twice as long as the movable process. Fovea of movable process situated in the apical portion of the process. Manubrium rather short. Acetabular seta placed well above the ventro-posterior angle of the clasper. Distal arm of sternum IX (Text-fig. 20, cf. Text-figs. 15, 16) about thrice as long as broad, with a markedly truncate apical margin which meets the dorsal margin at about a right angle; the distal arm bears relatively few setae.

LENGTH. ♂ 1½ mm.

REMARKS. The occurrence of the specimen described above in the nest of *Talpa europaea* is doubtless accidental; the true host is presumably a microtine rodent.

I have pleasure in naming this new species after Professor H. Strouhal, Director of the Naturhistorisches Museum in Vienna, whose unstinted efforts in obtaining material of fleas for the preparation of the flea-list in the *Catalogus Faunae Austriae* greatly increased our knowledge of the flea-fauna of his country, and who was one of the two collectors of the holotype.

***Rhadinopsylla (Actenophthalmus) pitymydis* (Zavattari), 1914 (species revocata)**

Neopsylla pitymydis. Zavattari, 1914, *Ann. Mus. civ. Stor. nat. Genova*, 46: 144, fig. (Cascinelle, Borzoli, Liguria, from *Pitymys savii* and *Pitymys subterraneus multiplex*).

Neopsylla pitymydis Zavattari. Jordan, 1921, *Ectoparasites*, 1: 141 (considered a synonym of *Rhadinopsylla isacanthus*).

Since I found that records of *R. isacantha* from Austria and Yugoslavia refer to misdetermined specimens of respectively *R. strouhali* and *R. dolomydis*, and that *R. isacantha* proved to consist of two subspecies which are only known from England, Holland and northern France, the suggested synonymy of *R. pitymydis* with *R. isacantha* is now very doubtful, and I regard *R. pitymydis* as a good species. Dr. C. Conci, of Genoa, very kindly searched for the 1 ♂ 1 ♀ syntypes (no other specimens being known) of Zavattari's species, but unfortunately they appear to have been lost. Zavattari's description and figure are very unsatisfactory, but the drawing shows a definite widening of the apex of the distal arm of sternum

IX; in *R. isacantha* this apex is never widened. Jordan (1921) examined the male syntype of *pitymydis* and commented on the greater width of the apex of sternum IX as compared with British specimens of *R. isacantha*. Zavattari's figure shows that the body of the clasper of *R. pitymydis* is broader and blunter than that of *R. isacantha*, but the drawing is very sketchy and may not be wholly correct; Jordan did not remark on any differences in the clasper.

***Rhadinopsylla (Actenophthalmus) orama* sp. n.**

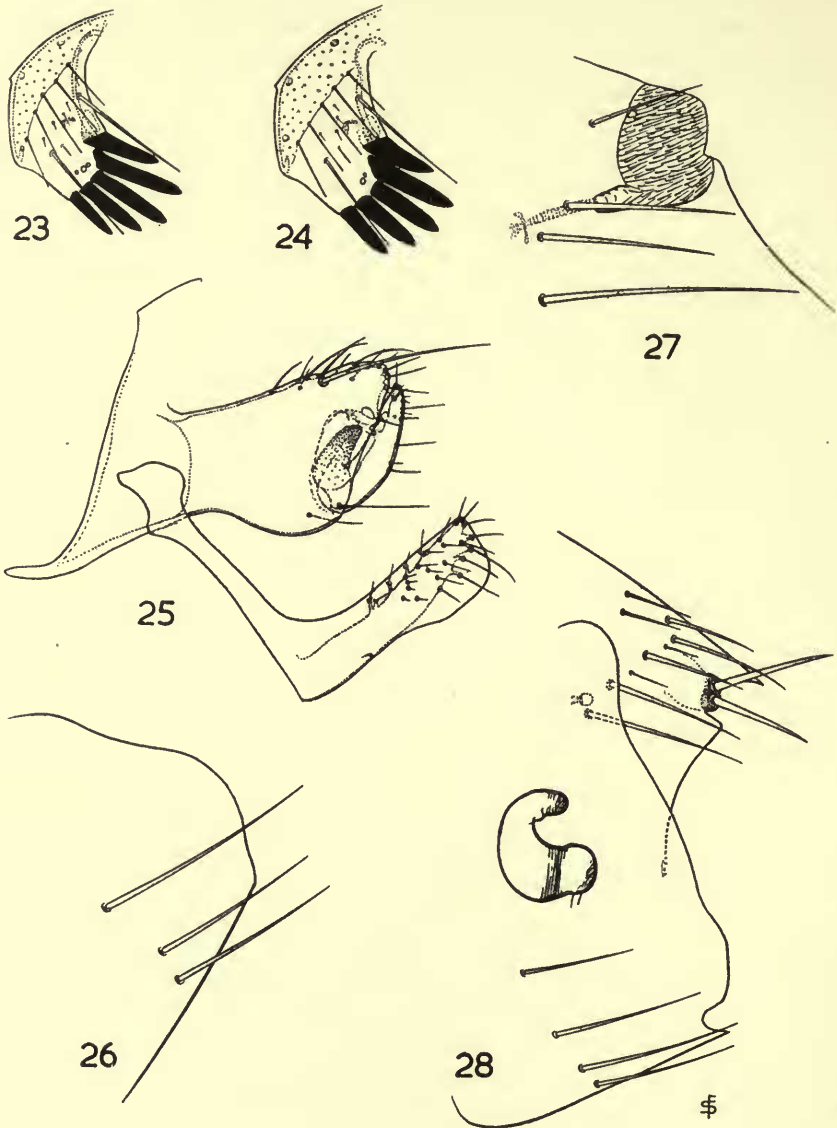
(Text-figs. 23-28, 75)

Rectofrontia "fraterna (Baker)". Fox, 1940, *Fleas eastern United States*: 38, 39, Pl. X, fig. 47 (Kensington, Maryland).

MATERIAL EXAMINED. From the collection of Lt.-Col. R. Traub: Male holotype and female allotype, Jonesville area, Lee Co., Virginia, U.S.A., from a nest of *Microtus pennsylvanicus*, 25.xii.1947, D. W. Pfitzer; 1 ♀ paratype, Covington, Virginia, from nest of *Neotoma magister*, 14.xi.1951, V. J. Tipton and J. J. O'Keefe (this specimen has been kindly presented by Lt.-Col. Traub to the Tring collection); 1 ♀ paratype, Giant City State Park, Illinois, from debris, 6.iii.1945, H. Ross and M. Sanderson. From the U.S. National Museum collection: 1 ♂ paratype, Kensington, Maryland, from *Microtus pennsylvanicus*, 22.ii.1924, H. S. Barber; 1 ♀ paratype Glen Mills, Delaware Co., Pennsylvania, from *Blarina brevicauda talpoides*, 28.i.1948, F. Harper; 1 ♂ paratype, U. T. farm, deciduous wood near orchard, Knox Co., Tennessee, 7.iii.1947, *Pitymys pinetorum*, D. W. Pfitzer (this specimen has been donated to the Tring collection by the U.S.N.M.). On Lt.-Col. Traub's request the holotype and allotype have been deposited in the U.S. National Museum collection, Washington D.C.

DIAGNOSIS. The new species is easily distinguishable, apart from the small size, from other North American representatives of the genus in the male by the distinct widening of the apical half of the distal arm of sternum IX, and in the female by the shape and striation of the spermatheca and the presence of one or two strong setae anterior to the widened part of the spiracular fossa of tergum VIII. The structure of the metathorax also forms a useful diagnostic character, and the number of marginal spinelets on terga I-VI is greater than in related North American species.

DESCRIPTION. Genal ctenidium normally consisting of five spines (in one male and one female there are only four spines on one side of the head), the uppermost of which is basally not very much broader than the neighbouring spine and its tip reaches to two-thirds the length of the latter spine (Text-figs. 23, 24). The five-segmented labial palp reaches to about four-fifths the length of the fore coxa. Pronotal ctenidium usually consisting of 20 or 21 relatively short spines (in one female 22, in another 24 spines). Metanotum without a vertical sclerotized ridge underlying the main row of setae and with a very short pale suture between the ventral margin of the collar and the dorso-anterior margin of the metepimeron (Text-fig. 75). There are no setae on the inner side of the hind tibia. The longest apical seta of the second hind tarsal segment reaches at most to the middle of the



FIGS. 23-28. *Rhadinopsylla (Actenophthalmus) orama* sp. n. 23. Preantennal part of head (holotype). 24. Preantennal part of head (allotype). 25. Clasper and sternum IX (holotype). 26. Sternum VIII (holotype). 27. Dorsal part of tergum VIII, ♀ (paratype, Illinois). 28. Segment VII and spermatheca (allotype).

fourth segment. Last tarsal segment of all legs with four pairs of lateral plantar setae. Only one seta below the spiracular fossa on terga III–VI. Number of marginal spinelets on terga I–VI, ♂: 3 (4), 4 (5), 3 or 4, 2 or 3, 2 or 3, 2 or 3; ♀: 3 (2), 4 (2), 3 or 4, 2 or 3, 2, 1 or 2. Sensillum with 12 trichobothria each side.

MALE. Tergum VIII without setae. Sternum VIII (Text-fig. 26) with a rounded posterior margin and only three setae each side; these setae are situated quite distantly from the posterior margin. Clasper (Text-fig. 25), measured from tip of manubrium to apex of fixed process, thrice as long as the movable process. The faintly marked angle in the anterior margin of the movable process (at level with the most ventral point of the fovea) is situated at three-sevenths the length from the apex of the movable process. One fairly long acetabular seta at level of, or a little above, the ventral end of the movable process. Distal arm of sternum IX (Text-fig. 25) markedly widened in its apical half, its setae not very long; the apical margin forms a right angle with the dorsal margin of the arm.

FEMALE. Posterior margin of tergum VII as in Text-fig. 28; posterior margin of sternum VII with a rather small subventral sinus, above which a broadly rounded lobe; the sternum with a row of only 3 or 4 setae per side (Text-fig. 28). Tergum VIII (Text-fig. 27) with a row of 2 or 3 setae below the large spiracular fossa, and one or two in front of the fossa; the latter is large but its tubular part is short (Text-fig. 27). Anal stylet about four times as long as its maximum width. Ductus bursae a little shorter than the fifth (uppermost) genal spine. Spermatheca with a wide bulga and only a rather narrow band of internal striations (Text-fig. 28).

LENGTH. ♂ $1\frac{1}{2}$ mm., ♀ $1\frac{1}{2}$ –2 mm.

REMARK. This species appears to be a winter flea and restricted geographically to the eastern United States; microtine rodents are very likely the true hosts.

Rhadinopsylla (Actenophthalmus) fraternus (Baker), 1895

(Text-figs. 29–33, 48, 60)

Typhlopsylla fraternus. Baker, 1895, *Canad. Ent.* **27**: 189, 190 (Brookings, South Dakota, host not recorded).

Actenophthalmus fraternus Baker. Baker, 1904, *Proc. U.S. nat. Mus.* **27**: 420, 423, 450.

Typhlopsylla fraternus Baker. Rothschild, 1913, *Entomologist*, **46**: 297 (referred to *Rhadinopsylla*).

Neopsylla hamiltoni. Dunn, 1923, in Dunn & Parker, *Publ. Hlth Rep., Wash.* **38**: 2770, 2775 (Spoon Creek, southwest of Darby, Montana, from *Neotoma cinerea*).

Rhadinopsylla fraternus Baker. Jordan, 1929, *Novit. zool.* **35**: 184.

Rectofrontia fraternus Bak. Wagner, 1936, *Canad. Ent.* **68**: 203.

Rectofrontia fraternus Baker. Jordan, 1937, *Novit. zool.* **40**: 270 (*N. hamiltoni* placed as a synonym).

Rectofrontia fraternus (Baker). Ewing & Fox, 1943, (part) *Misc. Publ. U.S. Dep. Agric.* (500): 80, fig. 9D.

Rectofrontia fraternus (Baker). Hubbard, 1947, (part) *Fleas western N. America*: 355, fig. 218.

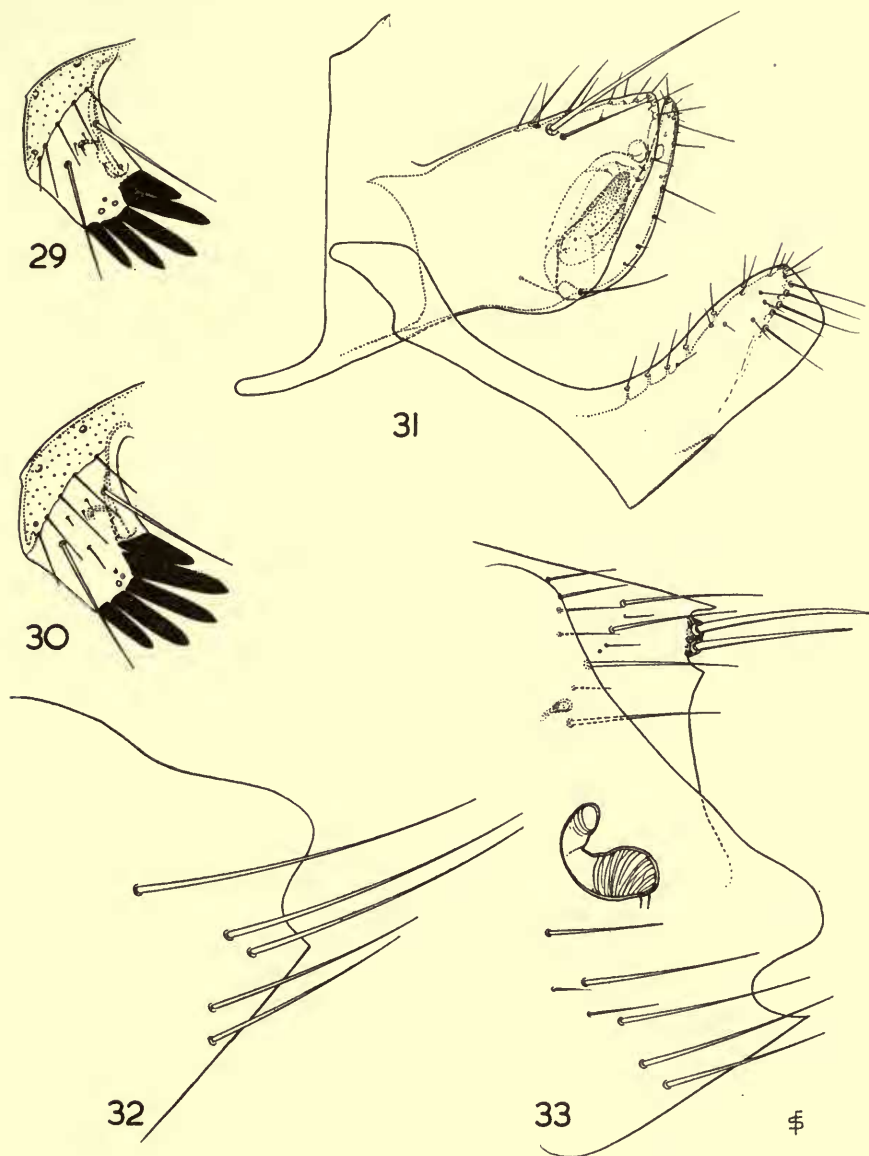
Rectofrontia fraternus (Baker). Holland, 1949, (part) *Siphonaptera of Canada*: 91, figs. 97–99, map 11.

Rhadinopsylla (Rectofrontia) fraternus (Baker). Morlan & Prince, 1955, *Texas Rep. Biol. Med.* **12**: 1045, fig. 3.

MATERIAL EXAMINED. From the collection of the U.S. National Museum: 1 ♂, Grand Forks, North Dakota, from *Citellus* sp., 20.v.1937, J. M. Davis; 1 ♀, Kremling, Colorado, from Wyoming ground squirrel (= *Citellus richardsoni elegans*), 13.iv.1939, N. B. Migutoff; 1 ♂, Hanna, Alberta, Canada, from *Citellus richardsoni*, 1.vi.1939, G. P. Holland; 1 ♀, High River, Alberta, from *Citellus richardsoni*, 28.viii.1938, G. P. Holland.—From the collection of the Tring Museum: 1 ♂, Ravalli Co., Montana, from *Neotoma cinerea*, 10.iii.1934, R. R. Parker; 1 ♀, Ravalli Co., Montana, from *Citellus columbianus*, 23.vi.1932, R. R. Parker; 6 ♂, 6 ♀, Calgary, Alberta, Canada, from *Citellus richardsoni*, 12.iv.1901, G. F. Dippie; 1 ♀, Calgary, Alberta, from *Mustela frenata longicauda*, 12.iv.1901, G. F. Dippie; 2 ♂, 8 ♀, Calgary, Alberta, from *Citellus richardsoni*, 11.iv.1907, G. F. Dippie; 1 ♀, Calgary, Alberta, from *Citellus richardsoni*, 17.iv.1907, G. F. Dippie; 2 ♂, 2 ♀, Calgary, Alberta, from *Mustela frenata longicauda*, 1910, G. F. Dippie; 2 ♂, 2 ♀, Calgary, Alberta, from *Mustela* sp., 20.viii.1913, Mackay and G. F. Dippie; 2 ♂, 3 ♀, Alberta, from *Mustela frenata longicauda*, 21.ix.1900, G. F. Dippie; 1 ♂, Alberta, from *Thomomys* sp., 1906, A. D. Gregson; 1 ♀, Alberta, from *Mustela* sp.; 1 ♀, Canadian National Park, Alberta, from *Ochotona princeps*, 26.viii.1899, G. F. Dippie; 2 ♂, 2 ♀, Blackfalds, Alberta, from *Thomomys* sp., 1910, A. D. Gregson; 1 ♀, Red Deer, Alberta, from *Microtus drummondi*, G. F. Dippie; 1 ♀, Park Co., Wyoming, from *Cynomys leucurus*, 20.vii.1940; 1 ♀, Jackson Co., Colorado, from *Cynomys leucurus*, 20.vii.1940; 1 ♀, Jackson Co., Colorado, from *Cynomys leucurus*, 15.vii.1937, F. M. Prince.

DIAGNOSIS. The male differs from related North American species by having a seta on tergum VIII and by details of the modified segments; both sexes usually possess two setae below the spiracle on several terga, while the other species described here have only one such seta. The female may be distinguished from that of other North American species by the fairly small size of the expanded part and of the tubular portion of the spiracular fossa of tergum VIII.

REDESCRIPTION. Genal ctenidium (Text-figs. 29, 30) consisting of five (occasionally six) spines, the upper of which is basally much broader than the lower four and reaches to about two-thirds the length of its neighbour. The five-segmented labial palp does not quite reach the apex of the fore coxa. The number of spines in the pronotal ctenidium varies from 21 to 27, the usual number being 24. Metanotum with a dorsal remnant of the vertical sclerotized ridge; the suture between the ventral margin of the collar and the dorso-anterior margin of the metepimeron is fairly long (Text-fig. 60). Usually two setae on the inner side of the hind tibia. The apex of the longest apical seta of the second hind tarsal segment does not reach the apex of the fourth segment, but usually to about the middle of the fourth segment or a little beyond. Fifth segment of all tarsi with four pairs of lateral plantar setae. Usually two setae below the spiracular fossa on terga III–VI in either sex. Number of marginal spinelets on terga I–VI, ♂: 3 (2–4), 2 or 3 (1–4), 2 (1–4), 2 (1–3), 1 or 2 (3), 0 (1); ♀: 3 (2–4), 2 or 3 (1–4), 2 (1), 1 or 2, 1, 0 (1) respectively. The upper of the two antesensilia in the female is a little longer than the lower; the margin of tergum VII below these setae forms about a right angle (Text-fig. 33). Sensillum apparently with 14 trichobothria each side in both sexes.



FIGS 29-33. *Rhadinopsylla (Actenophthalmus) fraterna* (Baker) (Ravalli Co., Montana).
 29. Preantennal part of head, ♂. 30. Preantennal part of head, ♀. 31. Clasper and sternum IX. 32. Sternum VIII. 33. Abdominal segment VII and spermatheca.

Male (Text-figs. 31, 32). Tergum VIII normally with one longish seta below the level of the spiracular fossa. Sternum VIII (Text-fig. 32) rather variable, with 5–8 long setae. Clasper (Text-fig. 31), measured from tip of manubrium to apex of fixed process, a little over twice as long as the movable process. Fovea of movable process situated at about one-fourth the length of the anterior margin from the apex. Manubrium not very long. Distal arm of sternum IX (Text-fig. 31) with a straight apical margin which forms about a right angle with the dorsal margin.

Female (Text-figs. 33, 48). Posterior margin of sternum VII (Text-fig. 33) with a fairly large ventral sinus; the sternum with 5–10 setae each side. Tergum VIII (Text-fig. 48) without setae anterior to the expansion of the spiracular fossa, but with a row of 3–6 setae below the spiracle. Anal stylet about four times as long as broad. Spermatheca as in Text-fig. 33.

LENGTH. ♂ 2–2½ mm.; ♀ 2–3 mm.

REMARK. This species is obviously a parasite of ground squirrels.

Rhadinopsylla (Actenophthalmus) arborea sp. n.

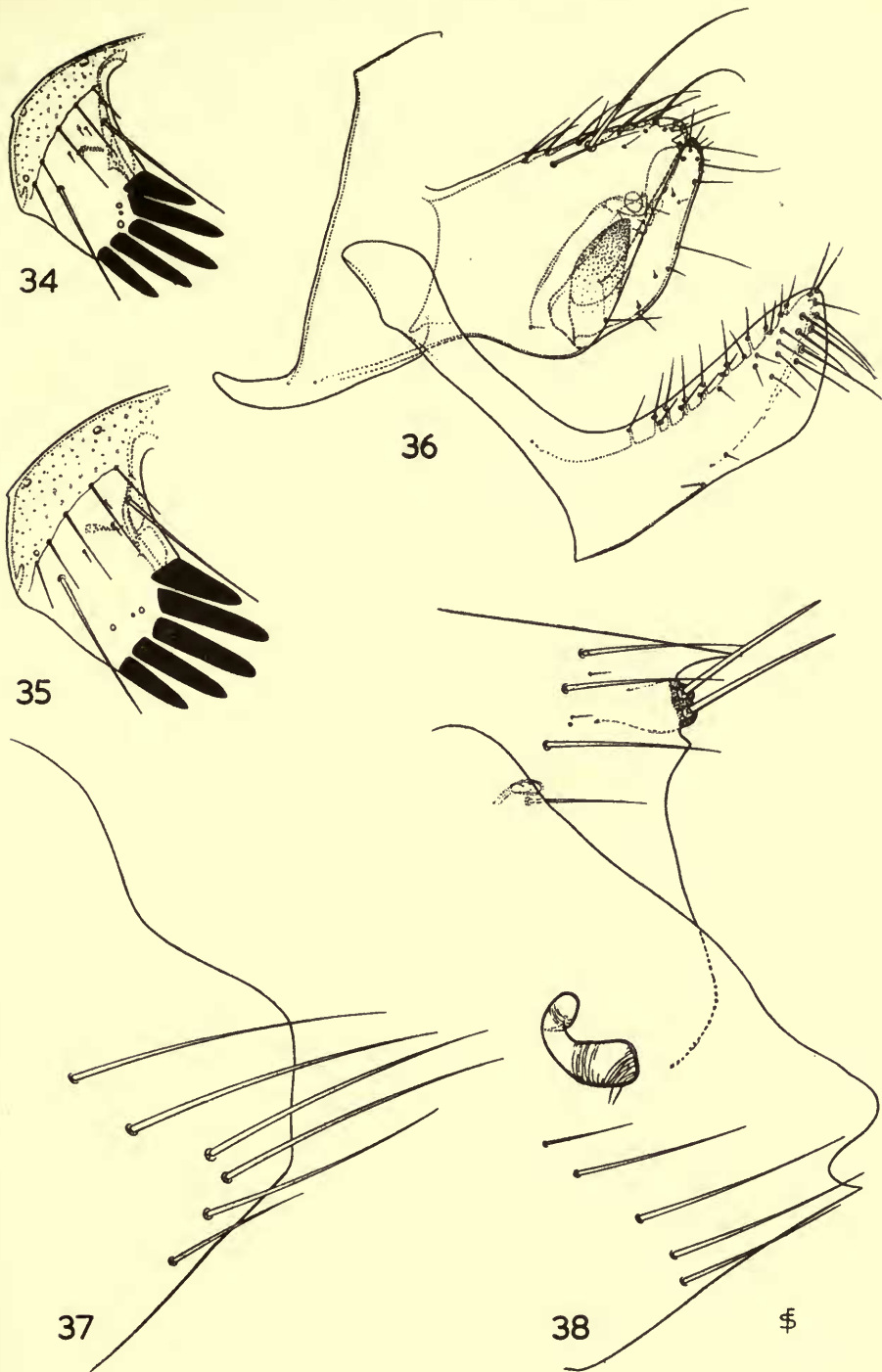
(Text-figs. 34–38, 50)

TYPE MATERIAL. Male holotype, female allotype and 10 ♂, 18 ♀ paratypes from Red Deer River, Canadian Rocky Mountains, from *Tamiasciurus hudsonicus baileyi*, 1907, A. D. Gregson.

DIAGNOSIS. Differing from related species by the greater relative height of the genal ctenidium; the male differs from *R. fraterna* by the absence of a seta on tergum VIII, from *R. orama* and *R. media* by having a lateral seta on the inner side of the hind tibia and from *R. difficilis* and *R. linta* by the structure of the modified segments. The female may be distinguished from that of related species by the high genal ctenidium and the long tubular portion of the spiracular fossa of tergum VIII.

DESCRIPTION. Genal ctenidium of five spines which do not touch each other at their bases; the height of the ctenidium is greater than in related species; the apex of the uppermost genal spine reaches to about two-thirds the length of the following spine (Text-figs. 34, 35). The five-segmented labial palp reaches to about four-fifths the length of the fore coxa. Pronotal ctenidium consisting of 22 spines (varying from 21 to 23). Metathorax of the *fraterna* type (see Text-fig. 60). Hind tibia with one lateral seta on the inner side. The longest apical seta of the second hind tarsal segment usually reaches to about the middle of the fourth segment. Fifth segment of all tarsi with four pairs of lateral plantar setae. Only one seta below the spiracular fossa on terga III–VI. Number of marginal spinelets on terga I–VI, ♂: 2 or 3 (1), 1 or 2 (3), 1 or 2 (3), 1 (2), 1 (0), 0 (1); ♀: 3 (2), 2 or 3 (1–4), 1 or 2 (3), 1 (2), 1 (0), 0 (1) respectively. Margin of tergum VII of the female below the two antesensilial setae distinctly concave (Text-fig. 38); the upper of these two setae is as long as or slightly longer than the lower.

Male (Text-figs. 36, 37). Tergum VIII without setae. Sternum VIII (Text-fig. 37) forming a broadly rounded lobe, with 4–7 long setae. Clasper (Text-fig. 36), measured from tip of manubrium to apex of fixed process, a little over twice as long



FIGS. 34-38. *Rhadinopsylla (Actenophthalmus) arborea* sp. n. (Red Deer River, Alberta, Canada). 34. Preantennal part of head (holotype). 35. Preantennal part of head (allotype). 36. Clasper and sternum IX (holotype). 37. Sternum VIII (holotype). 38. Abdominal segment VII and spermatheca (paratype).

as the movable process. Fovea of the movable process at about the middle of the anterior margin of the process. Manubrium short. The very short acetabular seta is situated near the ventral end of the movable process. Distal arm of sternum IX (Text-fig. 36) with a very oblique apical margin.

Female (Text-figs. 38, 50). Posterior margin of sternum VII with a ventral sinus, above which a well-developed rounded lobe; with 4 or 5 setae each side (Text-fig. 38). A vertical row of 3 or 4 setae below the spiracular fossa of tergum VIII; the apical expansion of the fossa is rather small, but the tubular portion is long (Text-fig. 50). Anal stylet about thrice as long as its maximum width. Spermatheca as in Text-fig. 38.

LENGTH. ♂ 2–2½ mm., ♀ 2¼–3 mm.

REMARK. The occurrence of the representatives of this new species on a tree-squirrel is most unexpected since no other species of the genus occur on arboreal hosts; in view of the fact that it is so abundantly different from the ground-squirrel species *R. fraterna*, the tree-squirrel may indeed be the true host for *R. arborea*—it is worth noting that a long series was collected from (presumably the nest of) that host.

Rhadinopsylla (Actenophthalmus) media sp. n.

(Text-figs. 39, 40)

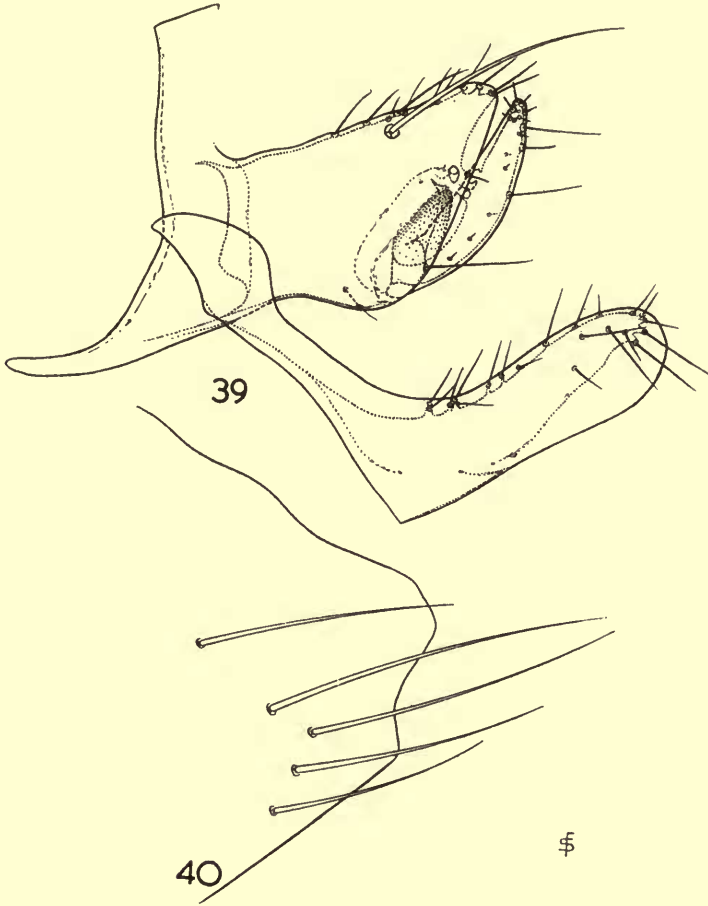
TYPE MATERIAL. Male holotype and two ♂ paratypes from Mingan, Quebec, Canada, from *Clethrionomys gapperi proteus*, 31.x.1947, R. Traub. Holotype in the U.S. National Museum, one paratype in the collection of Lt.-Col. R. Traub, one paratype in the Tring collection.

DIAGNOSIS. The male of this new species differs from that of related forms by the combination of the fovea of the movable process of the clasper being situated at about the middle of the anterior margin of the process and the rounded-off apex of the distal arm of sternum IX. Female not known.

DESCRIPTION. Genal ctenidium of the *fraterna* type, consisting of five spines, the apex of the uppermost spine reaching to about three-fifths the length of the fourth spine. The five-segmented labial palp reaches nearly to the apex of the fore coxa. Pronotal ctenidium with 21–22 spines. Metathorax of the *fraterna* type (see Text-fig. 60). No lateral setae on the inner side of the hind tibia. Longest apical seta of the second hind tarsal segment reaching only a little beyond the apex of the third segment. Fifth segment of all tarsi with four pairs of lateral plantar setae. One seta below the spiracular fossa on terga III–VI. Numbers of marginal spinelets on terga I–VI, ♂: 2 or 3, 2, 2, 2 (1), 1 or 2, 1 (0) respectively. Sensillum with apparently 12 trichobothria per side.

Male. Tergum VIII without setae. Posterior margin of sternum VIII (Text-fig. 40) forming a projecting lobe; the sternum normally with five long setae each side. Clasper (Text-fig. 39), measured from tip of manubrium to apex of fixed process, a little over twice as long as the movable process. Angle of anterior margin of movable process situated a little below the middle of the margin, the fovea being

at about the middle of the anterior margin. Manubrium fairly slender, but in one specimen somewhat shorter than in the specimen drawn. The acetabular seta is placed well above the level of the ventral margin of the movable process. Distal arm of sternum IX (Text-fig. 39) only a little widening towards the apex, which bears

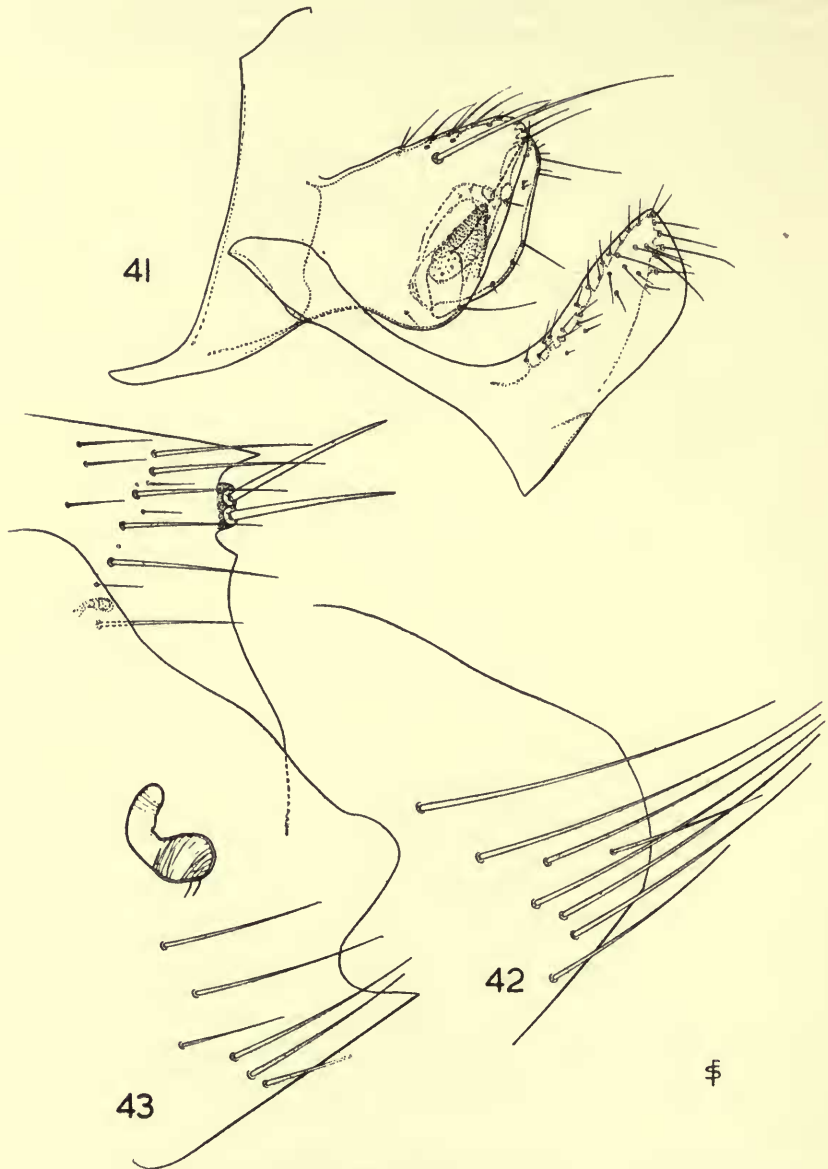


FIGS. 39, 40. *Rhadinopsylla (Actenophthalmus) media* sp. n. (holotype).
39. Clasper and sternum IX. 40. Sternum VIII.

rather few setae; the apical margin of this arm is smoothly rounded.

LENGTH. ♂ 2-2½ mm.

REMARK. In the Rothschild collection are a few specimens from Alberta and British Columbia (Kicking Horse Canyon) which agree fairly well with the Mingan males, but in view of geographical considerations I refrain as yet from identifying these west Canadian specimens as belonging to *R. media*.



FIGS. 41-43. *Rhadinopsylla (Actenophthalmus) difficilis* sp. n. 41. Clasper and sternum IX (holotype). 42. Sternum VIII (holotype). 43. Abdominal segment VII and spermatheca (allotype).

Rhadinopsylla (Actenophthalmus) difficilis sp. n.

(Figs. 41-43, 47)

TYPE MATERIAL. Male holotype, female allotype and one female paratype from Kelowna, British Columbia, from *Mustela* sp., collected on 24.xii.1919 (holotype) and xii.1922-i.1923 (allotype and paratype) by A. Tate; 1 ♀ paratype, Cedar Creek, Upper Columbia Valley, from *Putorius cicognani*, 26.v.1910, W. Wenmann.

DIAGNOSIS. The male can be distinguished from that of related forms by the structure of the modified abdominal segments; the female resembles that of *R. fraterna*, but it has only one seta below the spiracle of terga III-VI and the spiracular fossa of tergum VIII is somewhat larger.

DESCRIPTION. Genal ctenidium consisting of five spines, the uppermost of which is basally distinctly broader than the other four spines and its apex reaches to about two-thirds or five-eighths the length of the neighbouring spine. The five-segmented labial palp reaches to about three-fourths the length of the fore coxa. Pronotal ctenidium with 21 spines in the single available male, 21 to 23 in the female. Metathorax of the *fraterna* type (see Text-fig. 60). Hind tibia with or without a seta on the inner side. Longest apical seta of the second hind tarsal segment reaching to a little beyond the middle of the fourth segment. Fifth segment of all tarsi with four pairs of lateral plantar setae. One seta below the spiracular fossa in terga III-VI. Numbers of marginal spinelets on terga I-VI, ♂: 2 or 3, 2, 1 or 2, 1, 1, 0; ♀: 2 or 3, 2-4, 1 or 2, 1 or 2, 1, 0 (1) respectively. Tergum VII of female as in Text-fig. 43.

Male. Tergum VIII without setae. Posterior margin of sternum VIII (Text-fig. 42) very broadly rounded, the sternum with 5-8 long setae per side. Clasper (Text-fig. 41), measured from tip of manubrium to apex of fixed process, two and a half times as long as the movable process. Fovea situated at the middle of the anterior margin of the movable process, the latter rather broad and short. The acetabular seta is placed at the level of the lower end of the movable process. Distal arm of sternum IX (Text-fig. 41) about thrice as long as wide, with a fairly oblique apex.

Female. Posterior margin of sternum VII with a large ventral sinus; the sternum has a row of 4-6 setae each side (Text-fig. 43). A row of 3-4 setae below the spiracular fossa of tergum VIII, the fossa rather large (Text-fig. 47). Anal stylet about four times as long as broad. Spermatheca as in Text-fig. 43.

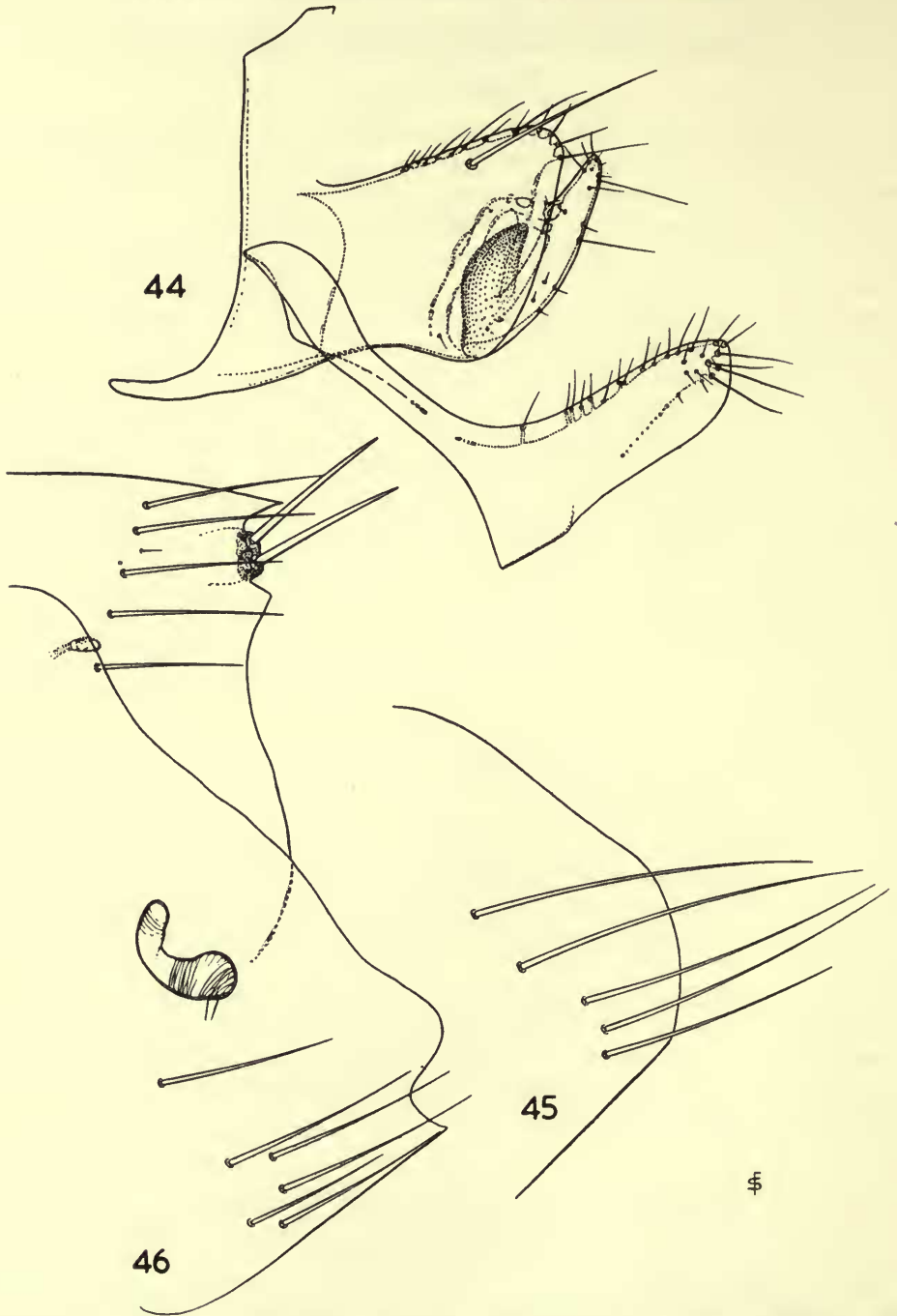
LENGTH. ♂ $1\frac{3}{4}$ mm., ♀ $2\frac{1}{2}$ mm.

Rhadinopsylla (Actenophthalmus) linta sp. n.

(Text-figs. 44-46, 49)

TYPE MATERIAL. Male holotype, female allotype and one female paratype from Atlin, British Columbia, from *Clethrionomys rutilus dawsoni* (holotype) and *Neotoma cinerea saxamans*, 1933, H. S. Swarth.

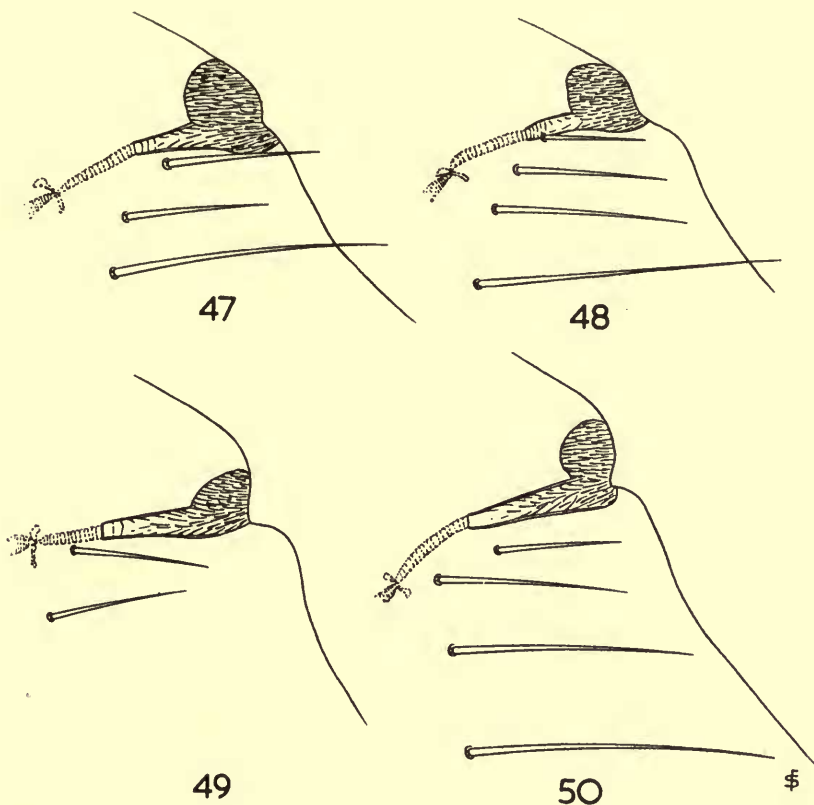
DIAGNOSIS. The male differs from that of related species with no setae on tergum



FIGS. 44-46. *Rhadinopsylla (Actenophthalmus) linta* sp. n. 44. Clasper and sternum IX (holotype). 45. Sternum VIII (holotype). 46. Abdominal segment VII and spermatheca (allotype).

VIII by the shape of sternum VIII, movable process and sternum IX; the female may not be easily distinguishable from that of related species.

DESCRIPTION. The upper of the five genal spines (in one female six on both sides) is basally broader than the other four spines and its apex reaches to about two-thirds the length of the neighbouring spine. The five-segmented labial palp reaches to about three-fourths the length of the fore coxa in the male, and to near



FIGS. 47-50. Dorsal part of tergum VIII, ♀, of: 47. *Rhadinopsylla (Actenophthalmus) difficilis* sp. n. (paratype). 48. *R. (A.) fraterna* (Baker) (Montana). *R. (A.) linta* sp. n. (allotype). 50. *R. (A.) arborea* sp. n. (allotype).

the apex of the fore coxa in the female. Pronotal ctenidium consisting of 22-23 spines. Metathorax of the *fraterna* type (see Text-fig. 60). One or two setae on the inner side of the hind tibia. Longest apical seta of the second hind tarsal segment reaching to the middle of the fourth segment. Fifth segment of all tarsi with four pairs of lateral plantar setae. One seta below the spiracular fossa on terga III-VI. Numbers of marginal spinelets on terga I-VI, ♂: 2 or 3, 2, 1, 1 or 2, 1, 1; ♀: 3 or 4, 2 (3), 2, 1 (2), 1 (0), 0 (1) respectively. Tergum VII of the female as in Text-fig. 46. Sensillum with 12 trichobothria each side.

Male. Tergum VIII without setae. Sternum VIII (Text-fig. 45) with six setae each side and a rounded posterior margin. Clasper (Text-fig. 44), measured from tip of manubrium to apex of fixed process, twice as long as the movable process. Angle of anterior margin of movable process placed a little above the middle of this margin. Manubrium fairly long. No trace of an acetabular seta could be found in the male, but this is no doubt an abnormality. Distal arm of sternum IX (Text-fig. 44) distinctly and gradually narrowing towards the oblique apex.

Female. Posterior margin of sternum VII with a fairly large ventral sinus; the sternum with 7-11 setae each side (Text-fig. 46). In one female (Text-fig. 49) there are 2 or 3 setae below the spiracle of tergum VIII, in the other 7 (this may be abnormal). Apical expansion of the spiracular fossa of tergum VIII very small (Text-fig. 49). Anal stylet four times as long as broad. Spermatheca as in Text-fig. 46.

LENGTH. ♂ $2\frac{1}{2}$ mm., ♀ $2\frac{1}{2}$ -3 mm.

The Taxonomic Value of the Metathorax in RHADINOPSYLLA

In general little use has been made of the structure of the metathorax of fleas for taxonomic purposes. Admittedly, in a number of genera the metathorax appears to be rather uniform in structure in all the members of a particular genus, but the members of *Rhadinopsylla* demonstrate a great variety in this segment, serving as an important aid in the identification of these fleas which on the whole are not easy to identify. The metathorax is practically not sexually dimorphic.

The main points of taxonomic interest in the metathorax of species examined¹ are:

I. The development of the internal sclerotized vertical ridge of the metanotum situated under the main row of setae; the following degrees of development can be distinguished:

- (a) The ridge is complete and its ventral end joins the upper part of the posterior vertical ridge of the metepisternum;
- (b) the ridge extends downward to about the lowest seta of the main row;
- (c) the ridge extends at most to about the middle of the main row of setae;
- (d) the ridge is absent.

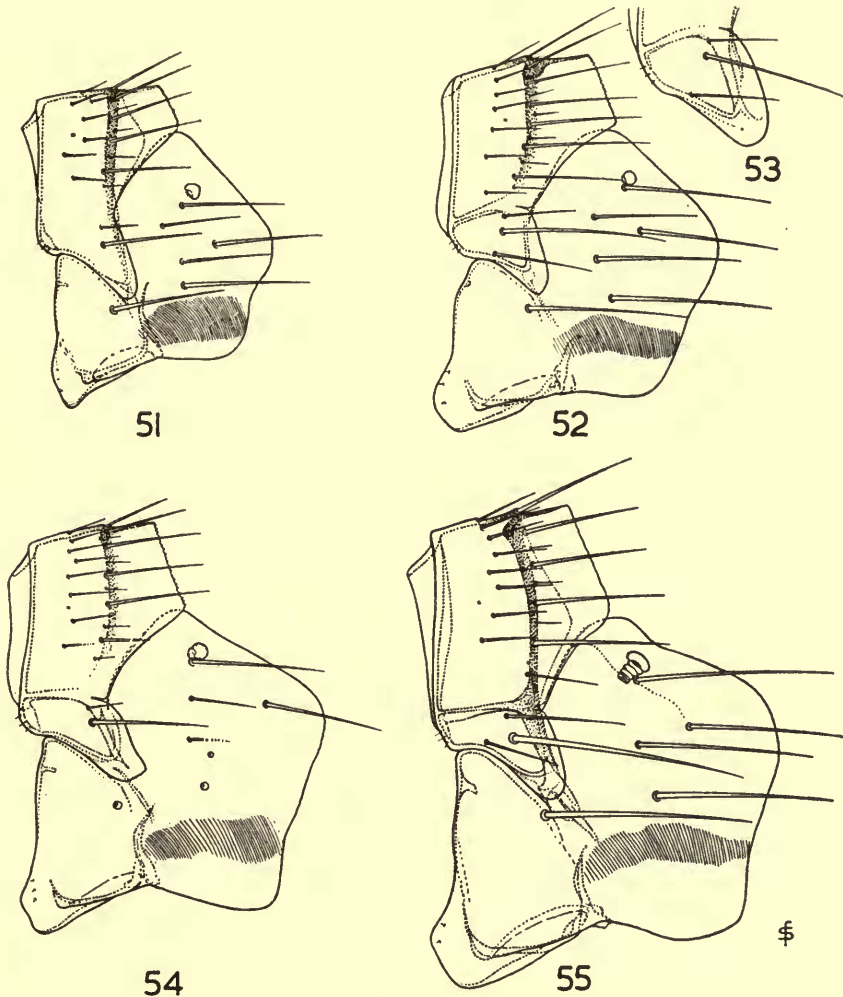
II. Number of setae on the metasternum; there is always one large seta (a), but in a number of species there is an additional shorter seta above it (b).

III. Suture between the ventral margin of the metanotal collar and the dorso-anterior margin of the metepimeron; the following degrees of development can be enumerated:

- (a) The suture extends downwards to below the dorso-posterior angle of the metepisternum;

¹ No specimens of the following species and subspecies of *Rhadinopsylla* have been available for study: subgenus *Ralipsylla*: *li li* Argyropulo, *li transbaikalica* Ioff & Tiflov, *semenovi* Argyropulo, *ventricosa murium* Ioff & Tiflov; subgenus *Actenophthalmus*: *accola* Wagner, *acuminata* Ioff & Tiflov, *altaica* (Wagner), *aspalacis* Ioff & Tiflov, *dahurica declinica* Tiflov, *d. tjanshan* Ioff & Tiflov, *d. vicina* Wagner, *caucasica* Argyropulo, *mexicana* Barrera, *pilosa* Ioff & Tiflov, *pseudodahurica* Scaloni and *rothschildi* Ioff.

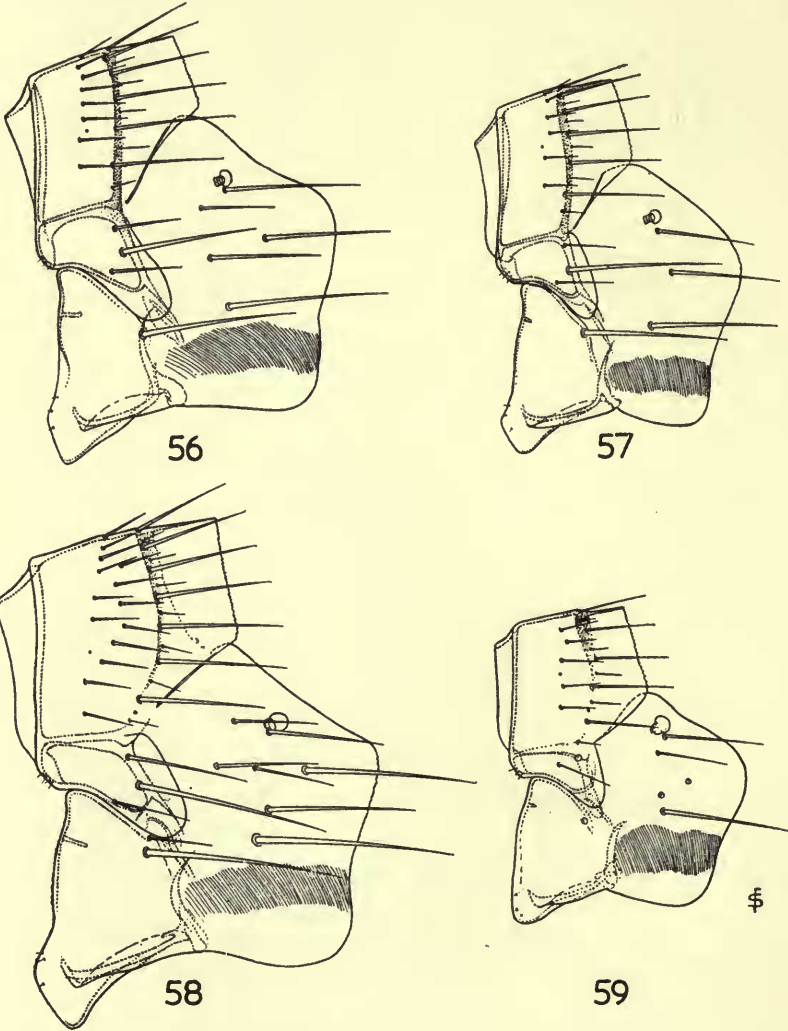
- (b) the suture reaches to or almost to that angle ;
 (c) the suture reaches to about the middle or two-thirds of the distance to the dorso-posterior metepisternal angle ;



FIGS. 51, 52. Metathorax of ♂ of: 51. *Rhadinopsylla (Micropsylla) sectilis goodi* (Hubbard) (Vancouver, British Columbia). 52. *Rhadinopsylla (Rhadinopsylla) cedestis* Rothschild (near Panfilov, S.E. Kazakhstan). Fig. 53. *Rhadinopsylla (Rhadinopsylla) masculana* J. & R. (allotype, ♀, Khenchela, Algeria). Figs. 54, 55. Metathorax of: 54. *Rhadinopsylla (Micropsylloides) jaonis* Jordan (♀, Ilan, NW. Sunkiang prov., Manchuria). 55. *Rhadinopsylla (Raliopsylla) ventricosa* Ioff & Tiflov (♂, Ottuk, Tyan-Shan).

(d) the suture reaches at most to half that distance but continues as a faint thin line ;

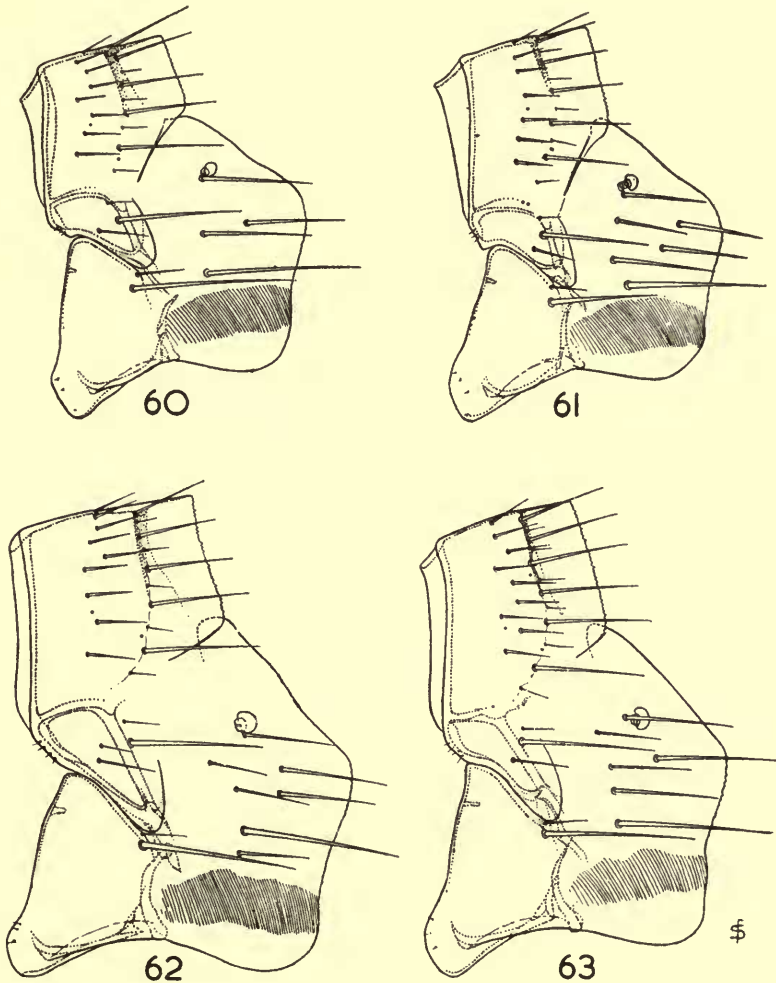
(e) the suture reaches at most to half the distance but does not usually continue as a faint thin line.



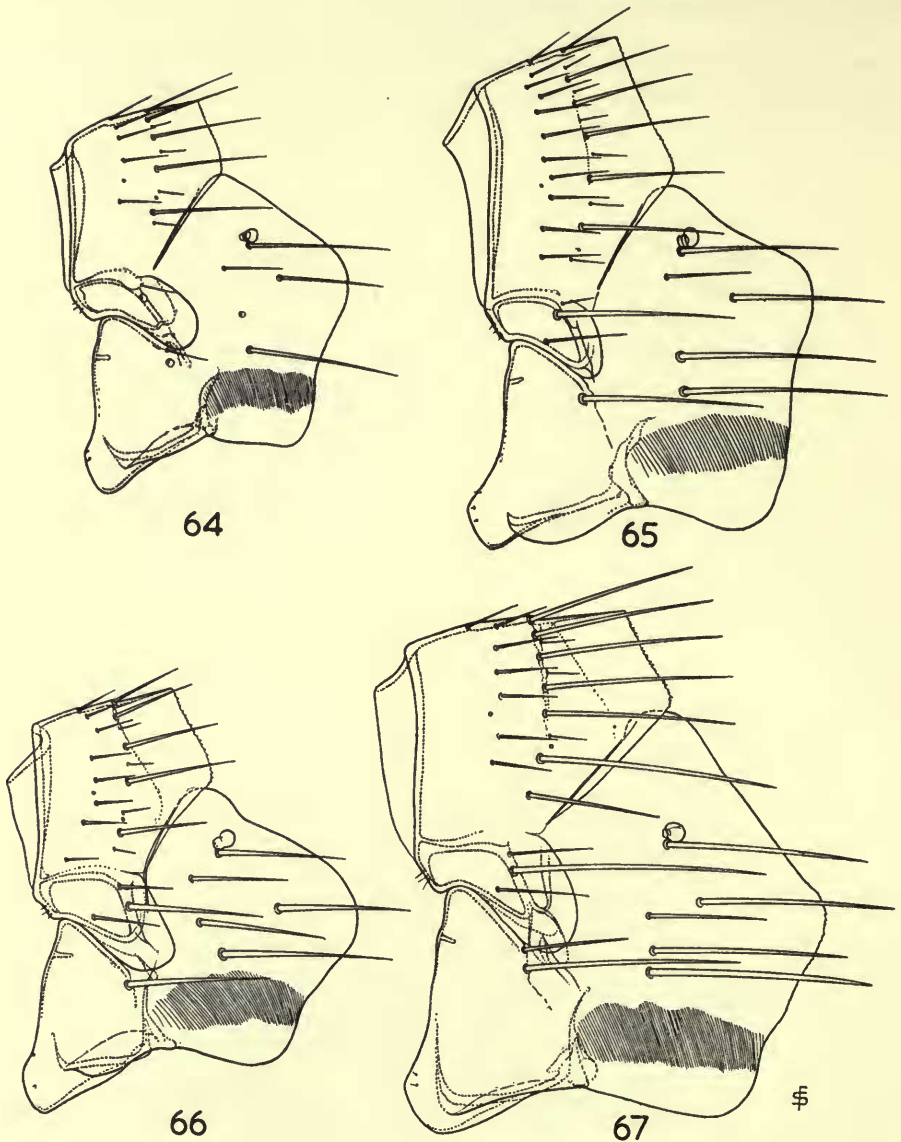
FIGS. 56-59. Metathorax of ♂ of: 56. *Rhadinopsylla (Actenophthalmus) pentacantha* (Rothschild) (Tring). 57. *R. (A.) japonica* Sakaguti & Jameson (paratype, Mt. Kurama, Japan). 58. *R. (A.) dives* Jordan (paratype, Tsenkiatien, 25 miles E. of Tungliao, Manchuria). 59. *R. (A.) dahurica dahurica* J. & R. (paratype, Manchouli (= Lupin), Manchuria).

IV. The dorsal horizontal ridge of the metepisternum. This is absent only in the subgenus *Micropsylla* (Text-fig. 51); in the species of the other subgenera it is developed in a variety of ways, see Text-figs. 52-75.

V. The junction between the dorsal and the posterior ridge of the metepisternum; only in three species of *Rhadinopsylla* s. str. (*cedestis*, *socia* and *ukrainica*) these two ridges do not join up.



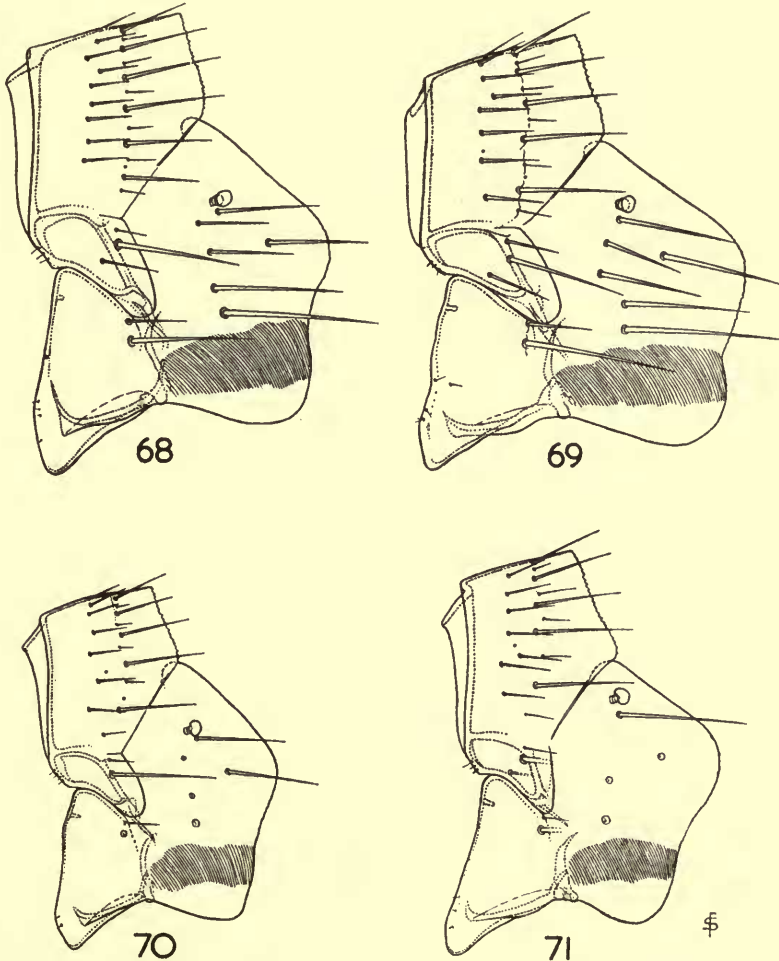
FIGS. 60-63. Metathorax of: 60. *Rhadinopsylla* (*Actenophthalmus*) *fraterna* (Baker) (♂, Ravalli Co., Montana). 61. *R. (A.) integella* J. & R. (♂, Schwarzwald Alp, B.O., Switzerland). 62. *R. (A.) valenti* Darskaya (♀, Taegu, Korea). 63. *R. (A.) insolita* Jordan (♂, Ta-Lin, near Tsienkiatien, Manchuria).



FIGS. 64-67. Metathorax of ♂ of : 64. *Rhadinopsylla (Actenophthalmus) multidenticulata* Morlan & Prince (Greenlee Co., Arizona). 65. *R. (A.) ioffi* Wagner (Katon-Karagai, Altai, E. Kazakhstan). 66. *R. (A.) mesa* J. & R. (near Wengen, B.O., Switzerland). 67. *R. (A.) heiseri* (McCoy) (Washington Co., Utah).

VI. Number of setae on the metepisternum; the normal number is three, but there are only two setae in the subgenera *Micropsylla* and *Micropsylloides* and in *R. (A.) tenella*, while in the one specimen of *R. (A.) strouhali* studied there is only one seta on either side, but that may be abnormal.

VII. Shape of metepisternum; this varies a great deal and I refer to Text-figs. 51-75 since the different shapes would be difficult to describe.

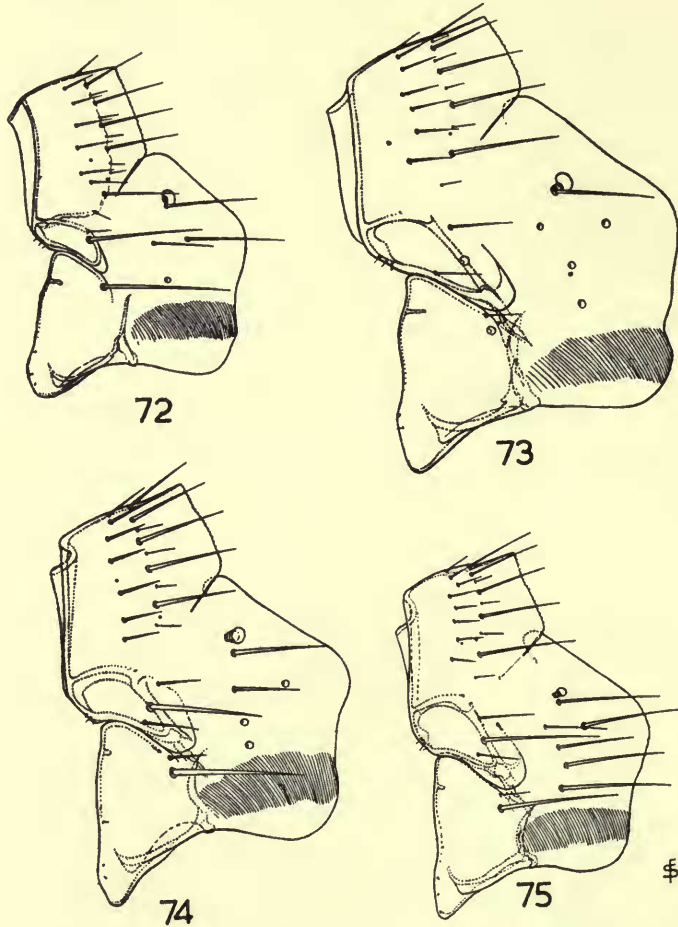


FIGS. 68-71. Metathorax of ♂ of: 68. *Rhadinopsylla (Actenophthalmus) isacantha continentalis* ssp. n. (Buré d'Orval, Meurthe-et-Moselle, France). 69. *R. (A.) dolomydis* Smit (paratype, Mt. Trebević, Bosnia, Yugoslavia). 70. *R. (A.) concava* Ioff & Tiflov (Korea). 71. *R. (A.) angusta* Tiflov (Trans-Ili Alatau, south of Alma Ata, Kazakhstan).

VIII. The shape of the metasternum and of the metepimeron differs considerably in the various species ; see Text-figs. 51-75.

IX. The chaetotaxy of the metepimeron varies somewhat ; see Text-figs. 51-75.

X. The shape and length of the furca are individually too variable to be of much use for taxonomic purposes.



FIGS. 72-75. Metathorax of: 72. *Rhadinopsylla (Actenophthalmus) tenella* Jordan (holotype ♂, near Tsenkiatien, Manchuria). 73. *R. (A.) attenuata* Jameson & Sakaguti (♀, Ohara, Honshu, Japan). 74. *R. (A.) bureschi* Jordan (holotype ♂, Cam-Kuria, Bulgaria). 75. *R. (A.) orama* sp. n. (holotype ♂, Lee Co., Virginia, U.S.A.).

Table of Characters I-III of the Metathorax in Rhadinopsylla.

	I(a)	I(b)	I(c)	I(d)	II(a)	II(b)	III(a)	III(b)	III(c)	III(d)	III(e)
Subgenus <i>Micropsylla</i>											
<i>sectilis</i> ssp. (Text-fig. 51)	+	-	-	-	+	-	-	+	-	-	-
Subgenus <i>Rhadinopsylla</i>											
<i>masculana</i> Text-fig. 53)	-	-	+	+	-	+	+	-	-	-	-
<i>bivirgis</i>	-	+	-	-	-	+	+	-	-	-	-
<i>cedestis</i> (Text-fig. 52)	-	+	-	-	+	-	+	-	-	-	-
<i>socia</i>	-	+	-	-	+	-	+	-	-	-	-
<i>ukrainica</i>	-	+	-	-	+	-	+	-	-	-	-
Subgenus <i>Micropsylloides</i>											
<i>jaonis</i> (Text-fig. 54)	-	+	-	-	+	-	+	-	-	-	-
Subgenus <i>Ralipsylla</i>											
<i>v. ventricosa</i> (Text-fig. 55)	+	-	-	-	+	-	-	+	-	-	-
Subgenus <i>Actenophthalmus</i>											
<i>pentacantha</i> (Text-fig. 56)	+	-	-	-	+	-	-	+	-	-	-
<i>japonica</i> (Text-fig. 57)	+	-	-	-	+	-	-	+	-	-	-
<i>dives</i> (Text-fig. 58)	-	+	-	-	-	+	-	-	+	-	-
<i>d. dahurica</i> (Text-fig. 59)	-	-	+	-	-	+	-	+	-	-	-
<i>fraterna</i> (Text-fig. 60)	-	-	+	-	-	+	-	-	+	-	-
<i>arborea</i>	-	-	+	-	-	+	-	-	+	-	-
<i>media</i>	-	-	+	-	+	-	-	-	+	-	-
<i>difficilis</i>	-	-	+	-	-	+	-	-	+	-	-
<i>linta</i>	-	-	+	-	-	+	-	-	+	-	-
<i>integella</i> (Text-fig. 61)	-	-	+	-	-	+	-	-	+	-	-
<i>valenti</i> (Text-fig. 62)	-	-	+	-	?	?	-	-	-	-	+
<i>insolita</i> (Text-fig. 63)	-	-	+	-	-	+	-	-	-	-	+
<i>multidenticulata</i> (Text-fig. 64)	-	-	-	+	-	+	-	+	-	-	-
<i>ioffi</i> (Text-fig. 65)	-	-	-	+	?	?	-	+	-	-	-
<i>mesa</i> (Text-fig. 66)	-	-	-	+	+	-	+	-	-	-	-
<i>mesoides</i>	-	-	-	+	+	-	+	-	-	-	-
<i>heiseri</i> (Text-fig. 67)	-	-	-	+	-	+	-	+	-	-	-
<i>isacantha</i> ssp. (Text-fig. 68)	-	-	-	+	-	+	-	-	-	+	-
<i>strouhali</i>	-	-	-	+	-	+	-	-	-	+	-
<i>dolomydis</i> (Text-fig. 69)	-	-	-	+	-	+	-	-	-	+	-
<i>concava</i> (Text-fig. 70)	-	-	-	+	-	+	-	-	-	+	-
<i>angusta</i> (Text-fig. 71)	-	-	-	+	-	+	-	+	-	-	-
<i>tenella</i> (Text-fig. 72)	-	-	-	+	?	?	-	-	-	-	+
<i>attenuata</i> (Text-fig. 73)	-	-	-	+	-	+	-	-	-	-	+
<i>buresschi</i> (Text-fig. 74)	-	-	-	+	-	+	-	-	-	-	+
<i>orama</i> (Text-fig. 75)	-	-	-	+	-	+	-	-	-	+	-

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